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Diamond Chuitna Coal Project

(U.S.) Environmental Protection Agency
Seattle, WA

Jun 88

U.S. Department of Commerce
National Technical Information Service
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Environmental Protection
Agency

Region 10
1200 Sixth Avenue
Seattle WA 98101

Alaska
Idaho
Oregon
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PB88-231576

Water Division

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EPA

Diamond Chuitna Coal Project

Draft Environmental Impact Statement

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The Draft Environmental Impact Statement for the Diamond Chuitna Coal Project was prepared pursuant to the National Environmental Policy Act. The actions to be considered are the approvals of permits for the proposed project located on the west side of Cook Inlet in southcentral Alaska. The project would consist of a surface coal mine, haul road, a method of transporting coal to a port facility on Cook Inlet, dock facilities, and other ancillary facilities. Three action alternatives and a No Action Alternative are discussed in detail. Rationale for eliminating various options is given. The preferred alternative would include construction of a port site at Ladd, an eastern transportation corridor, development of a housing facility at Lone Creek, and a conveyor system which would parallel the haul road and transport coal to the port site. The impacts of the proposed project are considered in terms of vegetation, fish, wildlife, wetlands, water quality and hydrology (both surface and subsurface), physical and chemical oceanography, air quality, visual resources, cultural resources, subsistence, socioeconomics, recreation, technical feasibility, and future uses of facilities.

The document is offered for public review and comment. Public hearings will be held to solicit comments on the Draft Environmental Impact Statement, draft EPA National Pollutant Discharge Elimination System permits, and U.S. Army Corps of Engineers authorized activities. Comments received on the Draft Environmental Impact Statement will be addressed in the Final Environmental Impact Statement.

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Department of Commerce

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO
ATTN OF: WD-136

To All Interested Government Agencies, Public Officials,
Public Groups, and Citizens

Pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969 and implementing Federal Regulations, the U.S. Environmental Protection Agency (EPA) is forwarding for your review and comment this Draft Environmental Impact Statement (DEIS) for the proposed Diamond Chuitna Coal Project. The project sponsor, Diamond Alaska Coal Company, proposes to develop a twelve million ton per year coal mine in the Beluga region of upper Cook Inlet, approximately 45 miles west of Anchorage, Alaska. The project would consist of an open pit mine and associated coal transportation and port facilities, service facilities, and housing accommodations.

Diamond Alaska Coal Company, in association with Granite Point Coal Port, Inc. and Tidewater Services Company has applied to EPA for National Pollutant Discharge Elimination System (NPDES) permits to discharge pollutants from the mine, port, coal loading, and housing facilities to navigable waters pursuant to the Clean Water Act. These facilities have been determined to be New Sources under Section 306 of the Clean Water Act and, according to Section 511(c)(1) of the Clean Water Act, are subject to the provisions of the National Environmental Policy Act. The draft NPDES permits have been released for public review concurrent with this DEIS (Appendix D).

The U.S. Department of the Army, Corps of Engineers (Corps), and the State of Alaska Department of Natural Resources (DNR) are cooperating agencies for the environmental impact statement. The Corps, under the authority of Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act, will evaluate proposed project-related activities in waters of the United States. Appendix C of this DEIS contains a complete description of the proposed activities requiring the Corps authorization. The DNR is authorized to review, pursuant to the Alaska Surface Coal Mining Control and Reclamation Act (AS27.21, 11 AAC Ch. 90), Diamond Alaska Coal Company's detailed application for a permit to conduct surface mining. This application is the subject of a separate review process.

Comments are invited on the DEIS, Draft NPDES permits, and the Corps authorization. These comments will be considered in the preparation of the Final Environmental Impact Statement and the applicable permits.

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT, PORTIONS OF THIS REPORT ARE NOT LEGIBLE. HOWEVER, IT IS THE BEST REPRODUCTION AVAILABLE FROM THE COPY SENT TO NTIS.

Combined public hearings on the DEIS, Draft NPDES permits, and the Corps authorization are scheduled for the following locations and times.

Anchorage	Tyonek
August 17, 1988 7:00 p.m. to 10:00 p.m. Federal Building Conference Room (1st Floor) 701 "C" Street Anchorage, Alaska	August 18, 1988 7:00 p.m. to 10:00 p.m. Tyonek Community Center Tyonek, Alaska

EPA will announce the availability of this document in the Federal Register on July 15, 1988, initiating a 60-day review and comment period. Written comments pertaining to the DEIS should be submitted by September 13, 1988, to:

Rick Seaborne
EIS Project Officer
Environmental Evaluation Branch, M/S WD-136
Environmental Protection Agency
1200 6th Avenue
Seattle, Washington 98101

Telephone: (206)442-8510
FTS 399-8510

Addresses for submittal of comments pertaining to the NPDES permit or State Certification are indicated in the public notice included with the draft NPDES permits in Appendix D of this document.

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

DIAMOND CHUITNA COAL PROJECT

Prepared by

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10

Cooperating Agencies

U.S. Department of the Army
Corps of Engineers

Alaska Department of Natural Resources

With Technical Assistance From

Dames & Moore

RESPONSIBLE OFFICIAL:

Robie G. Russell
Regional Administrator
Environmental Protection Agency
Region 10

Date: 6-9-82

COVER SHEET

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
DIAMOND CHUITNA COAL PROJECT
SOUTHCENTRAL ALASKA

Lead Agency	U.S. Environmental Protection Agency (EPA)
Responsible Official:	Robie G. Russell Regional Administrator Environmental Protection Agency 1200 Sixth Avenue Seattle, Washington 98101
Cooperating Agencies:	U.S. Army Corps of Engineers,(Corps) Alaska District, Regulatory Branch Alaska Department of Natural Resources (DNR)

Abstract of DEIS

The actions to be considered are the approvals of permits for the proposed Diamond Chuitna Coal Project located on the west side of Cook Inlet in southcentral Alaska. The project would consist of a surface coal mine, haul road, a method of transporting coal to a port facility on Cook Inlet, dock facilities, and other ancillary facilities. Three action alternatives and a No Action Alternative are discussed in detail. Rationale for eliminating various options is given. The preferred alternative would include construction of a port site at Ladd, an eastern transportation corridor, development of a housing facility at Lone Creek, and a conveyor system which would parallel the haul road and transport coal to the port site. The impacts of the proposed project are considered in terms of vegetation, fish, wildlife, wetlands, water quality and hydrology (both surface and subsurface), physical and chemical oceanography, air quality, visual resources, cultural resources, subsistence, socioeconomics, recreation, technical feasibility, and future uses of facilities.

Public DEIS Review and Comment Process

This DEIS is offered for review and comment to members of the public, special interest groups, and public agencies. Public hearings will be held to solicit comments on the DEIS, draft EPA National Pollutant Discharge Elimination System (NPDES) permits, and the Corps authorized activities (see attached notice regarding hearing locations, dates, and times). Comments received on the DEIS will be addressed in the Final Environmental Impact Statement (FEIS).

Location of DEIS or Technical and Reference Reports and Appendices

Copies of this DEIS and/or the major reports relating to the Diamond Chuitna Coal EIS are available at the following locations:

Seattle

EPA Region 10 Headquarters
1200 Sixth Avenue
Seattle, WA 98101

Anchorage

Dames & Moore
5761 Silverado Way, Bldg. P
Anchorage, AK 99518-1657

Division of Mining
Dept. of Natural Resources
Eighth Floor
3601 'C' Street (Frontier Bldg.)
Anchorage, AK

Dimond Alaska Coal Company
550 West 7th Avenue, Suite 1900
Anchorage, AK

Z.J. Loussac Library
3600 Denali Street
Anchorage, AK 99503

Kenai Peninsula Borough

Kenai Peninsula Borough*
Resource Development Dept.
147 N. Binkley
Soldotna, AK

Kenai Community Library**
163 Main Street Loop
Kenai, AK

Tyonek Community Center**
Tyonek, AK

Deadline for Comments: September 13, 1988

Address all Comments to:

Rick Seaborne
EIS Project Officer
Environmental Evaluation Branch (W/D 136)
Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-8510

*27 volume permit application only
**All reports except permit application

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SUMMARY

Purpose of and Need for Action

Diamond Alaska Coal Company (Diamond Alaska) proposes to develop a coal mine in the Beluga region of upper Cook Inlet, Alaska. The project would consist of a surface mine and associated transportation, shipping, and housing facilities. Diamond Alaska is proceeding with applications for the various permits and approvals needed for such a development.

The U.S. Environmental Protection Agency (EPA) has the responsibility for issuing New Source National Pollutant Discharge Elimination System (NPDES) Permits for wastewater discharges from the proposed Diamond Chuitna Coal project. EPA's NPDES regulations [40 CFR 122.29(c)(2)] require that the Environmental Impact Statement (EIS) include a recommendation on whether the NPDES Permit should be issued or denied. They also require that such action shall occur only after a complete evaluation of the projected impacts and recommendations contained in the final EIS (FEIS) [40 CFR 122.29(c)(3)].

In addition, the U.S. Department of the Army Corps of Engineers (Corps), Alaska District, has jurisdiction over this action under Section 10 of the River and Harbor Act of 1899 which provides for control over structures or work in or affecting navigable waters of the U.S.; and under Section 404 of the Clean Water Act which provides for regulation of the discharge of dredged or fill material into U.S. waters, including wetlands. The Corps intends to adopt this EIS to fulfill its National Environmental Policy Act (NEPA) obligations if its concerns are satisfied in the document.

Pursuant to NEPA and implementing regulations issued by the Council on Environmental Quality (CEQ), EPA, and the Corps, this EIS has been prepared to evaluate the potential impacts of the proposed actions on the environment and to fulfill the permitting requirements of EPA and the Corps. EPA has the lead responsibility for preparing this document and the Corps is a cooperating agency. The Alaska Department of Natural Resources (DNR) is also a cooperating agency because of its role in implementing the federal Surface Mining Control and Reclamation Act (SMCRA) through the Alaska Surface Coal Mining Program.

Project Description

Full development of the Diamond Chuitna coal project would involve a 10.9 million Mt (12 million short ton) per year surface coal mine in the Beluga area approximately 72 km (45 mi) west of Anchorage. The coal is sub-bituminous, low sulphur, low ash, high moisture steam coal with an average of 4,250 kilocalories per kilogram (7650 BTU per lb). The actual area to be mined during the projected 34-year life of the project would be approximately 2,029 ha (5,014 ac) with a maximum of 182 ha (450 ac) of pit being open at any one time.

Mining methods would employ shovels, draglines, hydraulic backhoes, front-end loaders, and haul trucks. Coal would be initially crushed at the mine and carried to a 22 ha (55 ac) mine service area by conveyor for further crushing and weighing. It would then be transported approximately 17.6 km (11 mi) by a single-span, 1.2 m (48 in) wide conventional conveyor to a port site on Cook Inlet either at Granite Point south of the mine or at Ladd east of the mine.

The entire conveyor structure would be supported by a horizontal steel pipe elevated about 0.6 m (2 ft) above the ground and would be about 2.9 m (9.6 ft) high overall. It would be enclosed on the top and one side except at stream crossings where the underside would also be enclosed. At appropriate locations, the conveyor would be raised or buried to permit human and large mammal passage across the corridor. The conveyor would be paralleled by a light duty maintenance road and an all-weather gravel/access haul road.

The onshore port facilities would occupy approximately 121 ha (300 ac) on the bluff above Cook Inlet at either Granite Point or Ladd. No one would be housed there. Up to 1.1 million Mt (1.2 million short tons) of coal would be stockpiled at the port for shipment. At full production, the offshore port facility would consist of an elevated trestle up to 3,810 m (12,500 ft) long, depending upon the port site, and would support twin conveyors for loading coal ships. At maximum length, the trestle would have a berthing depth of between 15.2 and 18.2 m (50 and 60 ft) and could service ships up to 108,864 Mt (120,000 dwt).

The workforce would be housed in permanent single-status housing and community facilities on an 8 ha (20 ac) site north of the Chuitna River near the mine (Lone Creek site), south of the Chuitna River midway between the mine and Granite Point (Congahbuna site), or northeast of the mine site (Threemile Creek site). The facilities would accommodate a total of 540 people at full production. A new gravel airstrip with a main runway of 1,524 m (5,000 ft) would be constructed adjacent to the housing site.

Average-load electrical power demands would be approximately 35 Mw with a maximum of 50 Mw. Power would be purchased from the existing Chugach Electric Association natural gas generating station at Beluga. Water for all facilities would be supplied by wells.

Construction employment would peak at approximately 1,300 and the permanent work force would total about 848 workers. Half of that total (424) would be at the project site at any one time working two 11-hour shifts per day. Employees would work a four-day-on, four-day-off schedule, and would be flown back to their homes in Anchorage or on the Kenai Peninsula during their off-work periods.

Construction would take approximately three years. Production would begin at a level of about 1.8 million Mt (2 million short tons) and increase to full production capacity as economics permit. The minimum time to full production would be four years from construction completion.

Existing Environment

The project area is largely undeveloped except for a system of primitive roadways that remain as a result of past oil, logging, and coal exploration activities. Most of the project area, including all the Diamond Chuitna coal lease area, is state land as is the Trading Bay State Game Refuge to the south. Most of the land east of the project area is owned or selected by the Tyonek Native Corporation, while Cook Inlet Region, Inc. owns the majority of the remainder of the land on the northeast, north, and west. The Kenai Peninsula Borough has either selected or received selection approval to land at or near both potential port sites.

Most of the project area consists of a broad, gently sloping plateau characterized by irregular ridges and depressions. The southern edge of the plateau terminates at a coastal bluff rising from the gravelly beaches of Cook Inlet. Much of the area is poorly drained with bogs and ponds. Vegetation on the area consists primarily of spruce-birch forest intermixed with open, muskeg terrain.

A major portion of the area provides moderate to high quality habitat for moose, brown bear, and black bear. A portion of a moose rutting concentration area is located within the northern half of the mine site; moose winter in a narrow zone along the coast. Birds occupying the project area include bald eagles, as well as small numbers of trumpeter swans and sandhill cranes.

The Chuitna River, which originates in the Alaska Range and enters Cook Inlet north of the village of Tyonek, bisects the project area and is the major drainage system within the project area. Several major tributaries to the Chuitna River are within or adjacent to the proposed mine area. Ground water originating within shallow aquifers in the mine area contributes significantly to the flow of the area streams. Tyonek and Old Tyonek Creeks are separate systems that drain the southern portion of the project area. Water resources are unpolluted and water quality is high.

Important fish resources in the Chuitna River include rainbow trout, chinook, coho, pink, and chum salmon. The river supports a small but high quality sport fishery and contributes salmon to commercial and subsistence fisheries within Cook Inlet.

Cook Inlet adjacent to the project area is characterized by high tides, strong currents, and high turbidity. Important marine life occupying the coastal area includes belukha whales and all 5 species of eastern Pacific salmon.

Air quality is high within the project area; noise pollution is low.

The closest development to the project area is the village of Tyonek, about 11 miles southeast of the mine area. About 95 percent of the approximately 270 residents of Tyonek are Alaska Natives. The village is accessible only by air or sea as there are no road connections to the more populated areas of southcentral Alaska. Subsistence hunting and fishing are important to the economic, cultural, social, and nutritional well-being of most of the permanent residents within the area.

Scoping

The EIS scoping process identified the following 10 issues of concern for the project:

- Maintain the integrity of the Chuitna River watershed by minimizing impacts to water quality and maintaining proper flows
- Maintain the quality of fish habitats in the Chuitna River system and minimize impacts to resident and anadromous fish
- Minimize disruption of wildlife and wildlife habitats, including important seasonal use areas and migration routes
- Assure successful reclamation of project components
- Minimize impacts to the commercial set net fishery and marine life movements near the port trestle
- Minimize impacts to subsistence resources, including access to those resources, as traditionally used by local residents
- Minimize the social, cultural, and economic impacts on local residents

- Maintain a regional perspective to minimize the cumulative impacts of this and other potential development projects

- Minimize chances of system failure by incorporating technically feasible component siting, design, and mitigation features

- Component siting, design, and mitigation features should be cost effective

Options Screening Process

To address the 10 issues, the scoping process identified 31 options for the 12 project components. A two-step options screening process was conducted to determine reasonable options. In the first step, all options were reviewed to eliminate from further consideration those which were clearly unreasonable or infeasible primarily for environmental or technical reasons. Nine options were eliminated.

In the second step, the remaining options were individually evaluated. Since all the options in the applicant's Proposed Projects were environmentally and technically reasonable and feasible, all of those options were retained so that the applicant's Proposed Projects would constitute formal alternatives to be analyzed during the analysis of alternatives process. Then, for each component where at least one option other than the applicant's choices remained, options were individually evaluated from the perspective of each resource or technical discipline (e.g., water quality, subsistence, technical feasibility). If it was determined that one of the other options was as good as, or better than, an applicant's option on an overall basis or if it addressed one or more of the 10 scoping issues in a significantly more favorable manner than did the applicant's option, that option was retained for the analysis of alternatives process.

Following the options screening process, the best options for all but two of the project components were relatively easy to identify. However, two components (transportation corridor/port site location and housing site location) had three options each that adequately addressed one or more of the 10 issues. These options were therefore retained and, with the other nine options, were used to form the alternatives (Table 1).

Identification and Description of Alternatives

The identification of action alternatives process was relatively straightforward as only three alternatives (combinations of options) were necessary to address the issues raised by the two components with more than one option remaining (transportation/port site location and

Table 1

OPTIONS USED TO FORM ALTERNATIVES

Component[1]	Option(s)
Mine Location	Fixed
Overburden Stockpile Location	Southeast
Mine Service Area	Fixed
Transportation System	
o Corridor Location[2]	Southern/Granite Point Northern/Ladd Eastern/Ladd
o Mode	Conveyor
Loading Facility	Elevated Trestle
Housing	
o Location(2)	Lone Creek Congahbuna Threemile Creek
o Type	Single Status
Airstrip	New
Water Supply	Wells
Power	Purchase

(1) One of original 12 components was dropped during option screening process.

(2) Component with more than one option remaining.

housing site location). Since the applicant wishes to retain two transportation corridor/port site options (southern/Granite Point and northern/Ladd), two alternatives using three options were identified as the applicant's Proposed Project. A third alternative, using the eastern/Ladd option, was also identified. The three action alternatives and the No Action Alternative for the Diamond Chuitna coal project are described below.

Southern/Granite Point Alternative

In addition to the fixed mine and mine service area locations, this alternative would site the overburden stockpile southeast of the mining limit. It includes a conveyor system within the southern transportation corridor to the port site at Granite Point. The coal-loading facility at the port would be an elevated trestle. A single-status housing facility with associated new airstrip would be located at the Lone Creek site. Water would be supplied to all facilities by wells, and power would be purchased from the Chugach Electric Association natural gas power station at Beluga.

Northern/Ladd Alternative

This alternative is the same as the southern/Granite Point alternative except the northern transportation corridor to a port site at Ladd would be used (Fig. 2-1).

Eastern/Ladd Alternative

This alternative would be the same as the northern/Ladd alternative except that the eastern transportation corridor to a port site at Ladd would be used (Fig. 2-1).

No Action Alternative

The No Action Alternative means that development of the Diamond Chuitna project would not occur. This would result from denial of one or more of the federal or state permits necessary for project development or from a decision by the applicant not to undertake the project.

Comparison of Alternatives

The impacts of each of the three action alternatives were compared against the 10 issue criteria identified during the scoping process. Then the impacts of each alternative relative to one another (Table 2) were compared for identification of the preferred alternative. The Congahbuna and Threemile housing/airstrip options were then compared with the Lone Creek option to determine whether either option provided a significant advantage over the Lone Creek site such that it could substitute for the Lone Creek option in one or more of the alternatives.

TABLE 2

EVALUATION CRITERIA MATRIX SHOWING RELATIVE TOTAL IMPACT VALUES ASSIGNED TO THE THREE ACTION ALTERNATIVES

Evaluation Criteria	Southern/ Granite Pt.	Northern/ Ladd	Eastern/ Ladd
1. Minimize risk of water quality degradation and alteration to flows	Moderate	Moderate	Low
2. Minimize impacts to fish and fish habitat	Moderate	Moderate	Low
3. Minimize impacts to wildlife and wildlife habitats	Moderate	High	Low
4. Minimize potential reclamation problems	Low	Low	Low
5. Minimize impacts to set net fishery	Moderate	High	High
6. Minimize impacts to traditional subsistence harvest activities	High	Low	Low
7. Minimize social, cultural, and economic impact upon local residents	Moderate	Moderate	Low
8. Minimize cumulative regional use impacts	Low	Moderate	Moderate
9. Minimize technical complexity	Low	Low	Low
10. Minimize cost	No Data	No Data	No Data

Identification of Preferred Alternative

The eastern/Ladd alternative, using the Lone Creek housing site, clearly had the least overall relative total impact value and was identified as the primary preferred alternative. Whether the applicant could develop an eastern corridor, however, is not certain since the corridor would cross private land owned by Tyonek Native Corporation. To date, the applicant has been unable to negotiate a right-of-way across that land. Thus, since there is no assurance that an eastern corridor could be developed even though identified as the preferred alternative, the southern Granite Point alternative was identified as the secondary preferred alternative.

Environmental Consequences of the Preferred Alternative

Overall environmental consequences would be similar regardless of whether the primary or secondary preferred alternative were developed. At maximum mine extent, project components would disturb about 2,029 ha (5,014 ac) of vegetated terrain. However, because of the ongoing reclamation of mined out areas, the actual unvegetated surface area at any one time in the mine life would be substantially less. About 24 percent of the area to be disturbed is classified as wetland.

Wildlife impacts would include loss of habitat during the mine life and for a period thereafter. Moose, brown bear, and black bear would be affected, as well as small mammals and birds. Loss of moose winter range at the proposed port site and a portion of a rutting area in the mine vicinity would be among the more important impacts. Movement of large mammals would be partially impeded by the conveyor system, although the presence of wildlife crossing areas would assure access across the transportation corridor. Reclamation of disturbed terrain would return wildlife values in the long term to near the premining condition.

Water quality and hydrology of Chuitna River tributaries within and adjacent to the mine site would be significantly altered during mine operation, for a period thereafter, and possibly over the long term depending on postmining hydrological characteristics and on the success of stream reclamation. Impacts would include increased suspended solids concentrations, higher turbidity, and reduced flow in some stream segments. A substantial portion of one tributary would be mined through causing direct habitat loss.

Loss of fish productivity, including such key species as chinook and coho salmon, would occur during mine operation and for a period thereafter. It is questionable whether mined-through streams could be returned to premining productivity; therefore, fish productivity loss could be a long term impact. Loss in productivity would have a small adverse impact on the Chuitna River sport fishery and a very small effect on commercial and subsistence fisheries in the marine environment.

Air quality would be degraded only locally with no significant impact to populated areas.

Socioeconomic impacts to the Anchorage and Kenai Peninsula population centers would be minor or insignificant. Tyonek residents would receive both beneficial and adverse impacts from the project. Increased employment opportunities and village income would be potential benefits while the increased development and human intrusion into the area would likely cause disruption to traditional Native lifestyles and loss of subsistence hunting and fishing opportunities.

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

1.1.1 The EIS Process

The National Environmental Policy Act (NEPA) of 1969 requires the preparation of an Environmental Impact Statement (EIS) whenever a proposed major federal action could significantly affect the quality of the human environment. Large development projects, such as the Diamond Chuitna Coal Project, normally require permits from one or more federal agencies. The issuance of these permits can be considered a major federal action if the range of anticipated impacts is of sufficient magnitude to potentially create significant effects. The agency or agencies involved make a determination regarding significant impacts and can elect to prepare an EIS if needed. The agency can either prepare the EIS itself or contract the preparation of all or part of the document (under the agency's supervision).

The NEPA regulations which outline the purpose, requirements, and procedures for the EIS process may be found in the Code of Federal Regulations at 40 CFR Parts 1500 to 1508. NEPA regulations also require that the EIS address, to the fullest extent possible, state and local planning requirements in addition to the federal permitting actions. An EIS provides an information base which assists state and local agencies in addressing their permitting and other regulatory actions.

The primary purpose of the EIS process is to ensure that environmental information is available to public officials and citizens before permit decisions are made and before actions are taken. The process must encourage and facilitate public involvement in the decisions affecting the quality of the human environment.

"Scoping" is the first step of the EIS process. The purpose of the scoping process is to provide an opportunity for members of the public, interest groups, and agencies to assist in defining the significant environmental issues related to the proposed project. Once these specific issues are identified, they are described in a document called the Responsiveness Summary that is distributed to all interested agencies and parties. These issues form the primary basis for determining the range of alternatives considered in the EIS.

Following scoping, the lead agency or agencies must ensure that sufficient environmental information is available to adequately address the significant issues raised during the scoping process. Alternative means of achieving the proposed project's objectives are developed and the environmental impacts are studied and compared. Finally, the EIS document is prepared and distributed to the public in draft form (DEIS) for a minimum of 45 days for formal review. During this period, public hearings or meetings are held to discuss the DEIS and to receive comments. Submission of written comments is also encouraged.

Comments are evaluated following public review and the DEIS is changed accordingly. All written comments received during the review period are either reproduced in the final EIS (FEIS) or summarized (depending on the number of comments) and the points raised are individually addressed in that document. The FEIS is then distributed for another public review period of at least 30 days before any decisions about the project can be implemented. This is to allow for additional public comments on the FEIS.

Once a permit decision has been made, a formal public record of decision is prepared by each permitting federal agency. The Record of Decision (ROD) states what major permit decision was made, identifies all alternatives considered (including those considered environmentally preferable), and may discuss preferences among alternatives based on factors such as economic, technical, national policy and agency mission considerations. The ROD also states what means to avoid or minimize environmental harm were adopted and the rationale.

1.1.2 EIS Document Structure

The basic format for an EIS is prescribed by the NEPA regulations. Each section has a specific purpose and often is required to include certain kinds of information. Following is a brief description of the major sections of this EIS.

- Summary - A summary of the EIS stressing major conclusions, areas of controversy, and the issues to be resolved is presented in this section.

- Purpose of and Need for Action - This chapter (1.0) specifies the underlying purpose of the action for which the EIS is being written and why the action is needed.

- The Proposed Project - This chapter (2.0) describes the individual components of the project as proposed by the applicant and the specific options being considered for each component. It tells how the project will be developed.

- Alternatives Including the Proposed Action - Chapter 3.0 is the heart of the EIS. It describes all the initial options that were considered for the project, why many of them were eliminated, and how the final options and alternatives (set of options comprising a total project) were selected. Then, based on the information and analyses presented in the chapters that follow (Affected Environment and Environmental Consequences), the chapter presents the environmental impacts of the proposed project alternatives in comparative form, sharply defining the issues and providing a clear basis for choice by the decision-makers and the public. It also identifies and describes the preferred alternative.

- Affected Environment - Chapter 4.0 succinctly describes the existing environment of the area which would be affected by development of the project. It explains the environment as it currently exists before project development begins.

- Environmental Consequences - This chapter (5.0) forms the scientific and analytic basis for the comparison of alternatives in Chapter 3.0. It details the potential environmental impacts which could be expected for each alternative considering the mitigation, monitoring, and reclamation procedures which would be used. In addition, it describes unavoidable impacts, discusses any irreversible or irretrievable commitments of resources, and describes the relationship between short- and long-term productivity.

- Mitigation, Reclamation and Monitoring - Chapter 6.0 outlines potential mitigation and reclamation measures planned relative to each environmental component and describes the proposed program to monitor the effectiveness of those measures.

- Consultation and Coordination - This chapter (7.0) describes the process for soliciting input from agencies and the public and how the process is coordinated with the agencies' permitting processes.

- Public Response to the DEIS - Chapter 10.0 includes a response to comments received during the DEIS review, both at public hearings and as written comments. Responses indicate how the final document was changed or why no changes were made.

- Appendices - These sections incorporate important supplementary material prepared in connection with the EIS which is more appropriately presented separately from the body of the document.

1.2 DESCRIPTION OF THE PROPOSED ADMINISTRATIVE ACTIONS

This section describes the proposed federal administrative actions that have created the need for this EIS.

Diamond Alaska Coal Company (Diamond Alaska) proposes to develop a 10.9 million Mt (12 million short tons) per year coal mine in the Beluga region of upper Cook Inlet, Alaska. The project would consist of a surface mine and associated transportation, shipping, and housing facilities. Diamond Alaska has initiated the process of applying for the various permits and approvals needed for such a development.

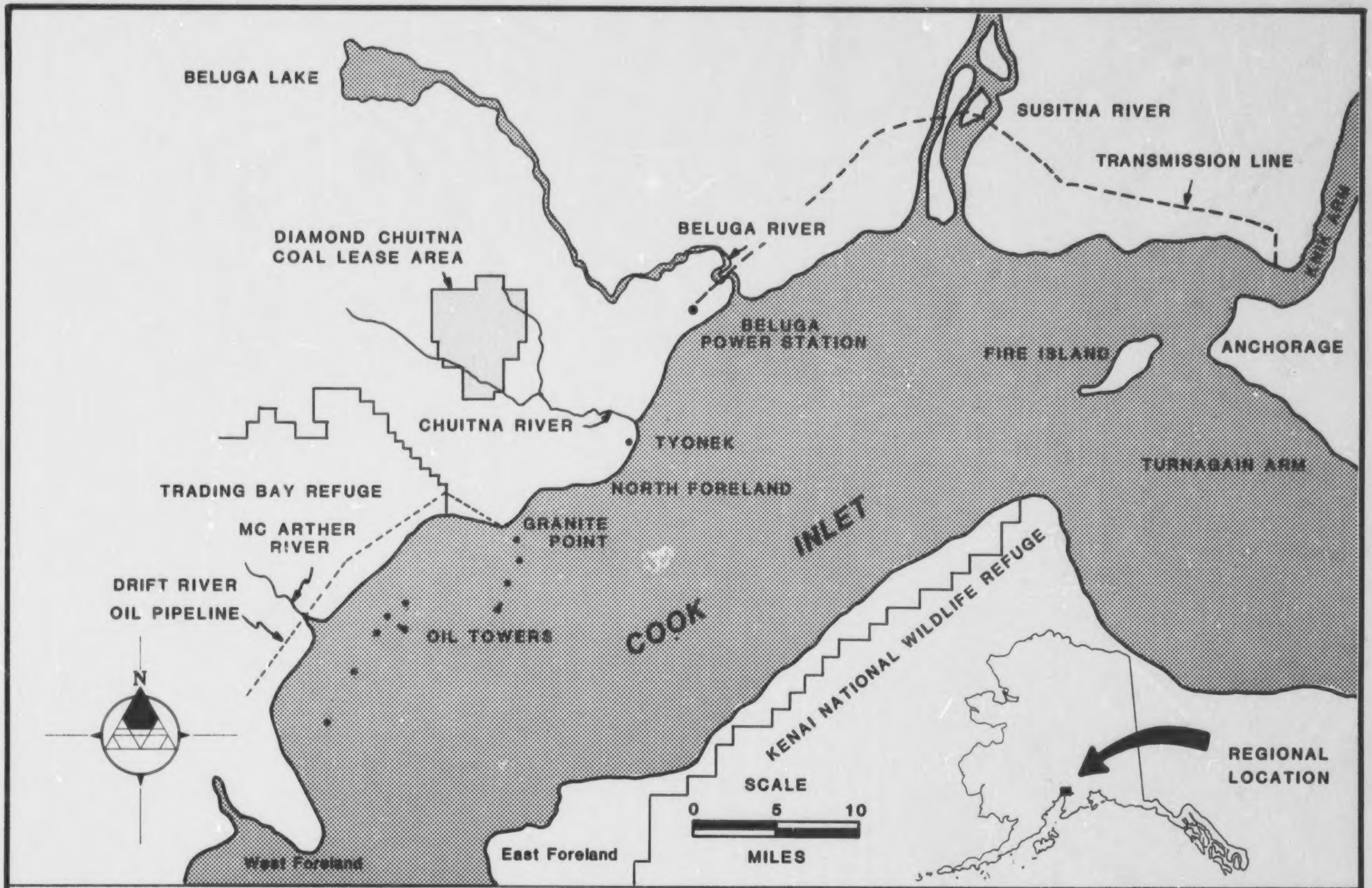
The U.S. Environmental Protection Agency (EPA) has been considering the issuance of New Source National Pollutant Discharge Elimination System (NPDES) Permits for wastewater discharges from the proposed Diamond Chuitna Coal Project. In addition, the U.S. Department of the Army Corps of Engineers (Corps), Alaska District, has jurisdiction over this action under Section 10 of the River and Harbor Act of 1899 which provides for control over structures or work in or affecting navigable waters of the U.S.; and under Section 404 of the Clean Water Act which provides for regulation of the discharge of dredged or fill material into U.S. waters, including wetlands. Action by the Corps could result in denial of the permit, issuance of the permit, or issuance of the permit with stipulations. The Corps intends to adopt this EIS to fulfill its NEPA obligations if its concerns are satisfied in the document.

EPA's NPDES regulations [40 CFR 122.29(c)(2)] require that the EIS include a recommendation on whether the NPDES Permit should be issued or denied. They also require that such action shall occur only after a complete evaluation of the projected impacts and recommendations contained in the final EIS (FEIS)[40 CFR 122.29(c)(3)].

Pursuant to NEPA and implementing regulations issued by the Council on Environmental Quality (CEQ), EPA, and the Corps, this EIS has been prepared to evaluate the potential impacts of the proposed actions on the environment and to fulfill the permitting requirements of EPA and the Corps. EPA has the lead responsibility for preparing this document and the Corps is a cooperating agency. The Alaska Department of Natural Resources is also a cooperating agency because of its role in implementing the federal Surface Mining Control and Reclamation Act through the Alaska Surface Coal Mining Program (see Section 1.5).

1.3 PROJECT LOCATION, HISTORY, AND STATUS

The proposed project would be located on the northwest side of upper Cook Inlet, approximately 72 km (45 mi) west of Anchorage and 12.8 km (8 mi) west of the Native community of Tyonek (Fig. 1-1). The area is bounded by the Beluga


BELUGA LAKE
SUSITNA RIVER
TRANSMISSION LINE
KNIK ARM
DIAMOND CHUITNA
COAL LEASE AREA
BELUGA RIVER
BELUGA
POWER STATION
FIRE ISLAND
ANCHORAGE
CHUITNA RIVER
TYONEK
TURNAGAIN ARM
TRADING BAY REFUGE
NORTH FORELAND
GRANITE
POINT
INLET
MC ARTHER
RIVER
DRIFT RIVER
OIL PIPELINE
COOK
OIL TOWERS
KENAI NATIONAL WILDLIFE REFUGE
N
REGIONAL
LOCATION
SCALE
0
5
10
MILES
West Foreland
East Foreland

DIAMOND CHUITNA PROJECT LOCATION

Diamond Chuitna Environmental
Impact Statement

FIGURE 1-1

River on the north, the Alaska Range on the west, the flats of Trading Bay State Game Refuge on the southwest, and Cook Inlet on the south and east.

The mine would be situated north of the Chuitna River at an elevation of approximately 229 m (750 ft) and would be 19.2 km (12 mi) from tidewater at Granite Point (Fig. 1-2). Topography of the project area consists of gently undulating hills and ridges at the mine site interspersed with small streams, ponds, and muskegs, becoming flatter south of the Chuitna River as elevation slowly decreases toward Granite Point. Mixed coniferous and deciduous forests and woodlands extend over most of the project area.

The presence of coal outcrops in the Beluga region of upper Cook Inlet has been known for decades. The area containing these outcrops was selected soon after statehood by the State of Alaska under the federal government's mental health land grant entitlement. The five coal leases affected by the proposed project were issued by the State to the Bass, Hunt, Wilson Group between 1972 and 1978. Coal leases in the area have also been issued to other companies.

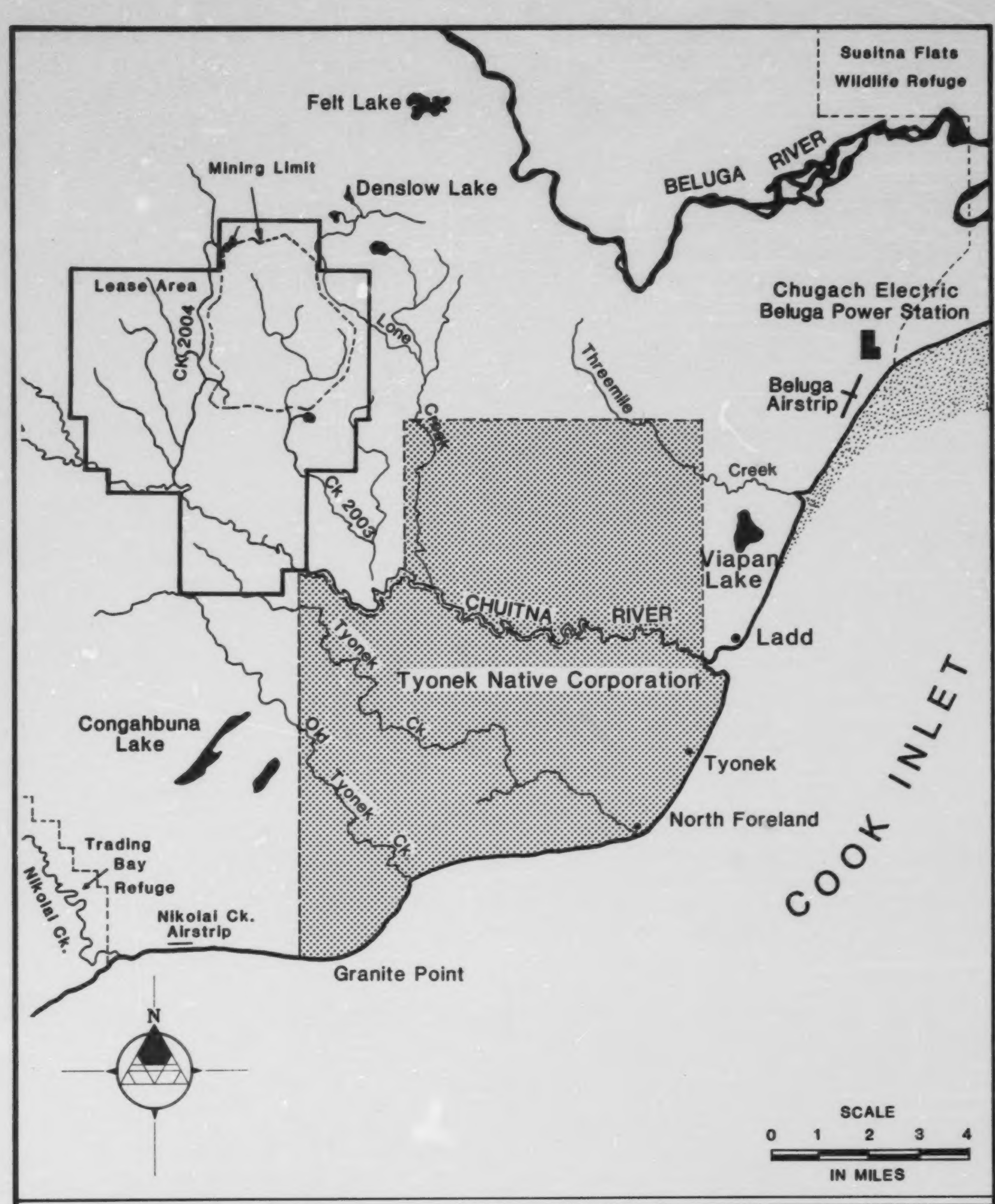
Throughout the 1970s, further exploration occurred on the leases, including core drilling to define the reserves. In 1981, the Diamond Shamrock Chuitna Coal Joint Venture was formed to develop the project. The venture partners are Maxus Energy Corporation, a large integrated natural resources company, and the Lone Creek Coal Company. The operating arm of the joint venture is Diamond Alaska Coal Company of Anchorage, a subsidiary of Maxus Energy Corporation. The joint venture holds sublease agreements to the five leases (ADL nos. 36911, 36913, 36914, 37002, and 59502) which constitute the entire lease area.

Diamond Alaska has overseen an intensified drilling program and the completion of many engineering and economic studies, which included a detailed Preliminary Design Phase Study. Environmental baseline studies were begun in 1982 and largely completed in 1984. Limited preconstruction monitoring has also begun.

The coal is sub-bituminous, low sulphur, low ash, high moisture steam coal with an average of 4,250 kilocalories per kilogram (7,650 BTU per pound). Diamond Alaska has been marketing the coal to electric utilities, cement, and industrial users in the Pacific states of the United States and to Pacific rim countries, primarily Japan, Taiwan, and Korea.

1.4 SCOPING ISSUES

During the scoping process, which involved the full participation of Diamond Alaska, members of the public, special interest groups, and agencies involved in the EIS pro-


Susitna Flats
Wildlife Refuge
Felt Lake
BELUGA RIVER
Mining Limit
Denslow Lake
Lease Area
Ck 2004
Lone Creek
Threemile Creek
Chugach Electric
Beluga Power Station
Beluga
Airstrip
Ck 2003
Viapan
Lake
CHUITNA RIVER
Ladd
Tyonek Ck
Tyonek Native Corporation
Congahbuna
Lake
Old Tyonek Ck
Tyonek
North Foreland
COOK INLET
Trading
Bay
Refuge
Nikolai Ck.
Nikolai Ck.
Airstrip
Granite Point
N
SCALE
0 1 2 3 4
IN MILES

DIAMOND CHUITNA PROJECT AREA

Diamond Chuitna Environmental Impact Statement

FIGURE 1-2

cess, the following 10 issues were identified as being of major concern if the project is developed:

Issue 1: Maintain the integrity of the Chuitna River watershed by minimizing impacts to water quality and maintaining proper flows

The proposed project has the potential to alter the characteristics of the Chuitna River watershed in a number of ways:

- Direct disturbance of stream courses in mined areas
- Interruption or diversion of ground water regimes which could alter input to surface drainages
- Diversion of surface water flow from one subbasin to another
- Degradation of water quality as a result of sediment load from disturbed areas, chemical leaching from coal or overburden, or pollution from sanitary facilities

Issue 2: Maintain the quality of fish habitats in the Chuitna River system and minimize impacts to resident and anadromous fish

Fish habitats could be affected by direct disturbance of stream courses, reduced flows, or water quality degradation.

Issue 3: Minimize disruption of wildlife and wildlife habitats, including important seasonal use and migration areas

The proposed project has the potential to alter the nature and productivity of wildlife habitats and to impede the movements of wildlife.

Issue 4: Assure successful reclamation of project components

The surface mine and other components of the proposed project would temporarily disturb substantial areas of vegetated terrain and existing stream courses. Returning these disturbed areas to a biologically productive condition is a significant concern.

Issue 5: Minimize impacts to the commercial set net fishery human user and marine life movements near the port trestle

The existence of port facilities would have the potential to impede various coastal activities engaged in by humans and to alter the movement of fish and marine mammals.

Issue 6: Minimize impacts to subsistence resources, including access to those resources, as traditionally used by local residents

Hunting, fishing, and trapping activities required by local residents for their subsistence could be affected by either reduced numbers of fish and wildlife in existing use areas or by restricted access to traditional use areas.

Issue 7: Minimize the social, cultural, and economic impacts on local residents

Development of the proposed mine and its housing and transportation infrastructure could affect the lifestyles and livelihoods of local residents, particularly residents of Tyonek.

Issue 8: Maintain a regional perspective to minimize the cumulative impacts of this and other potential development projects

Facilities developed for the proposed project could influence the future development of the area and the extent of cumulative impacts. Therefore, a regional perspective for facility planning should be employed to minimize the range of cumulative impacts that could occur.

Issue 9: Minimize chances of system failure by incorporating technically feasible component siting, design, and mitigation features

If components or mitigation and reclamation measures become too complex or utilize uncertain technology, then an increased risk of failure could result.

Issue 10: Component siting, design, and mitigation features should be cost effective

If project costs exceed reasonable or practical limits then economic feasibility could become an issue.

1.5 STATUS OF PERMITS AND APPROVALS

One of the purposes of the EIS process is to address the environmental and other concerns of federal, state, and local agencies responsible for the various regulatory functions associated with ultimate approval of a project. The EIS process recognizes the informational needs of these agencies as they proceed through their permitting processes and seeks to incorporate relevant information to assist those agencies in their permitting decisions. The public hearings, which are an integral part of the EIS process and cover all concerns pertinent to the project, also serve as public participation forums for state and federal permitting processes.

The reader should take note, however, that concurrent with the EIS process, the Alaska Department of Natural Resources (DNR) has conducted a thorough review of Diamond Alaska's 27-volume application for a permit to conduct surface mining. This permit process, conducted pursuant to the Alaska Surface Coal Mining Control and Reclamation Act (AS27.21,11AAC Chapt. 90), entailed a much more thorough and detailed analysis of Diamond Alaska's proposed 10-year mining plan than this EIS can reasonably accommodate. Through delegated authority, compliance with the state surface mining laws assures compliance with the federal laws governing surface mining under the Surface Mining Control and Reclamation Act. The EIS serves as an overall planning tool that addresses component siting and operations over the 34-year life of the project and beyond. While certain important aspects of the 10-year mining plan are discussed and analyzed in the EIS, the reader is encouraged to contact the DNR at the address shown on page 7-8 for information related to the surface mining permits.

Diamond Alaska is pursuing the full range of other permits and approvals required for their proposed project. Table 1-1 lists the major permits required and their current status. Superimposed on the individual permit application procedures are two more or less separate but interrelated environmental review processes. The first is the NEPA review process of which this EIS is a part. As discussed in Section 1.2, this EIS provides the background and documentation necessary for processing the major federal permits. In addition, the State of Alaska, through a centralized permit review process administered by the Office of Management and Budget (OMB), reviews all the state permits with individual regulatory agencies. Although each agency issues its own permits, permit decisions are coordinated through OMB on any projects which affect the State's coastal zone. OMB makes the final determination of consistency with the Alaska Coastal Management Program.

Table 1-1

STATUS OF MAJOR PERMITS AND APPROVALS

Project Component	Lease/Permit/Approval	Regulatory Agency	Application Submittal Date	Status
Prior to Alaska Coastal Management Program (ACMP)				
Transportation	Right-of-Way Permit and Easement, ADL 200680 (to Granite Point) - joint application with Beluga Coal Company	ADNR (state)	July 12, 1978 Amended April 15, 1982	In adjudication
Port	Land Lease, ADL 66114 (Granite Point uplands) - joint application with Beluga Coal Company	ADNR (state)	October 24, 1974 Amended November 25, 1981	In adjudication
Port	Tide and Submerged Lands Lease, ADL 66115 (Granite Point) - joint application with Beluga Coal Company	ADNR (state)	October 24, 1974 Amended November 25, 1981	In adjudication
Alaska Coastal Management Program (ACMP) - Phase I				
	AK860218-26A (Mine) AK860218-27A (Trans/Housing) AK860218-28A (Port)	Determined Consistent with the ACMP August 21, 1987		
Mine	Permit to conduct surface mining, No. 01-85-796	ADNR/DOM	January 15, 1985	August 21, 1987, Positive Decision
Port	Water Rights, LAS No. 5558 (Granite Point)	ADNR/DLWM	February 7, 1986	Review in Progress
Housing	Water Rights, LAS No. 5556	ADNR/DLWM	February 7, 1986	Review in Progress
Mine	Water Rights, LAS No. 5557	ADNR/DLWM	February 7, 1986	Review in Progress
Housing	Land Lease, ADL 221186 (includes solid water site)	ADNR/DLWM	May 16, 1985	In adjudication
Housing	Solid Waste Disposal Permit, No. 8623-BA003	ADEC	February 7, 1986	Review in Progress
Transportation	Anadromous Fish Protection Permit, Title 16 (Granite Point, housing, landing strip)	ADF&G	February 7, 1986	Review in Progress
Mine	Land Lease, ADL 222752 (Permanent Solid Waste Disposal Site)	ADNR/DLWM	February 14, 1986	In adjudication
Mine	Solid Waste Disposal Permit, No. 8623-BA002 (Permanent Site)	ADEC	February 7, 1986	Review in Progress
Mine	Land Lease, ADL 222753 (Temporary Solid Waste Disposal Site)	ADNR/DLWM	February 14, 1986	In adjudication
Mine	Solid Waste Disposal Permit, No. 8623-BA001 (Temporary Site)	ADEC	February 7, 1986	Review in Progress

Table 1-1

STATUS OF MAJOR PERMITS AND APPROVALS
(continued)

Project Component	Lease/Permit/Approval	Regulatory Agency	Application Submittal Date	Status
Transportation/ Housing	Land Lease, ADL 221187 (Landing Strip)	ADNR/DLWM	May 16, 1985	In adjudication
Mine	Rights-of-Way (5 separate approvals for vegetation analysis plots)	ADNR/DLWM	May 16, 1985	Review in Progress
Mine	Anadromous Fish Protection Permit, Title 16	ADF&G	February 7, 1986	Review in Progress
Transportation	Material Sites, ADL 221188 through 221190 (3 sites)(Granite Point)	ADNR/DLWM	May 16, 1985	Review in Progress
Alaska Coastal Management Program (ACMP) - Phase II includes NEPA Process, federal approvals and state permits for Ladd				
		Begins with distribution of DEIS		
Mine	National Pollutant Discharge Elimination System (NPDES)(19 discharges)	U.S. EPA	July 26, 1985 Amend	Under review - pending completion of the NEPA process
Port (Granite Point)	National Pollutant Discharge Elimination System (NPDES)(2 discharges)	U.S. EPA	July 26, 1985 Amend	Under review - pending completion of the NEPA process
Housing	National Pollutant Discharge Elimination System (NPDES)(3 discharges)	U.S. EPA	July 26, 1985 Amend	Under review - pending completion of the NEPA process
Port (Ladd)	National Pollutant Discharge Elimination System (NPDES)(1 discharge)	U.S. EPA	January 1987	Under review - pending completion of the NEPA process
Mine, Housing, Transportaton and both Ports	Department of the Army Permit (Sections 10 & 404)	COE	June 5, 1987 Revised	Under review - pending completion of the NEPA process
Mine, Housing, and both Port Sites	Certificate of Reasonable Assurance (Water Quality Certification)	ADEC	Review of NPDES Applications	Review in Progress
Transportation	Right-of-Way Permit and Easement, ADL 223706 (Ladd)	ADNR/DLWM	June 5, 1987	In adjudication
Port	Tide and Submerged Lands Lease, ADL 223707 (Ladd)	ADNR/DLWM	June 5, 1987	In adjudication

Table 1-1

STATUS OF MAJOR PERMITS AND APPROVALS
(continued)

Project Component	Lease/Permit/Approval	Regulatory Agency	Application Submittal Date	Status
Port	Water Rights, LAS No. to be assigned (Ladd)	ADNR/DLWM	June 5, 1987	Review in Progress
Transportation	Material Sites, ADL 223708 through 223717 (10 sites)(Ladd)	ADNR/DLWM	June 5, 1987	Review in Progress
Transportation	Anadromous Fish Protection Permit, Title 16 (Ladd)	ADF&G	June 5, 1987	Review in Progress
Port	Wastewater Disposal Permit (Ladd)	ADEC	June 5, 1987	Review in Progress
Other Permits and Approvals (ACMP - Phase III for Final Design and Construction) applied for as needed				
Transportation	Right-of-Way Easement	KPB	April 24, 1987	In adjudication
Mine, Port & Housing	Plan review for sewerage systems of water and wastewater treatment works	ADEC	---	To be submitted
Mine, Transportation, Port & Housing	Plan approval drainage/erosion	KPB	---	To be submitted
Mine, Housing, Transportation and Port	Air Quality Control Permit to Operate	ADEC	December 1986 Amended	Review in Progress
Mine	Miscellaneous Burning Permits	ADEC	---	To be submitted

2.0 THE PROPOSED PROJECT

2.1 INTRODUCTION

This chapter describes the Diamond Chuitna coal project -- what the various parts (components) of the project are, where they would be located, and how they would function. The applicant's plans for construction and operation of each component (e.g., power source, worker housing, etc.) are described. For some components (e.g., location of the transportation corridor), the EIS scoping process, the third party EIS team, a federal or state agency or the applicant itself have identified more than one option. In these cases, each of the other options is described in addition to the applicant's proposed option.

The applicant has proposed mitigation measures for each component to reduce adverse impacts. These measures are described in this chapter. The discussions of environmental consequences (Chapter 5.0) assume these mitigation measures will be in place if the project is constructed. Mitigation measures other than (or in addition to) those which have been proposed by the applicant are described in Chapter 6.0. These other mitigation measures could be required of the applicant as stipulations to permits issued by federal and state agencies.

The applicant's proposed mitigation measures for the mine itself are only for the first ten years of the project. A new mitigation plan, based upon experience, would be developed toward the end of that period to be applied to the next mining increment.

The Alaska Surface Coal Mining Control and Reclamation Act (AS 27.21) and pertinent regulations (11 AAC Chapter 90) require very detailed information about several aspects of an applicant's proposed plan of operation (e.g., water drainage control and treatment, reclamation). The volume of this information makes it impractical to incorporate it into this EIS. Therefore, this chapter only summarizes the major aspects of the proposed project. However, references to the location of this detailed information in Diamond Alaska Coal Company's 27-volume Permit Application to Conduct Surface Coal Mining (1985) are given for readers who wish to pursue more specific details (see Section 7.7 for locations of the permit application).

2.2 PROJECT OVERVIEW AND COMPONENTS

2.2.1 Introduction

Since the applicant has not yet concluded a final contract for sale of coal, the length of time it would take to develop the project to its full production capacity of 10.9 million Mt (12 million short tons) is unknown, but would occur in stages depending upon economics. As coal production increased, staged development of the mine, housing site, overland coal transportation system, port site, and loading trestle would occur commensurate with production requirements. Under optimal conditions, full production capacity could be reached after four years of operation. However, it is likely that full production would take longer than four years to reach and, thus, the full impacts of the completed project would not occur until some undetermined time in the future.

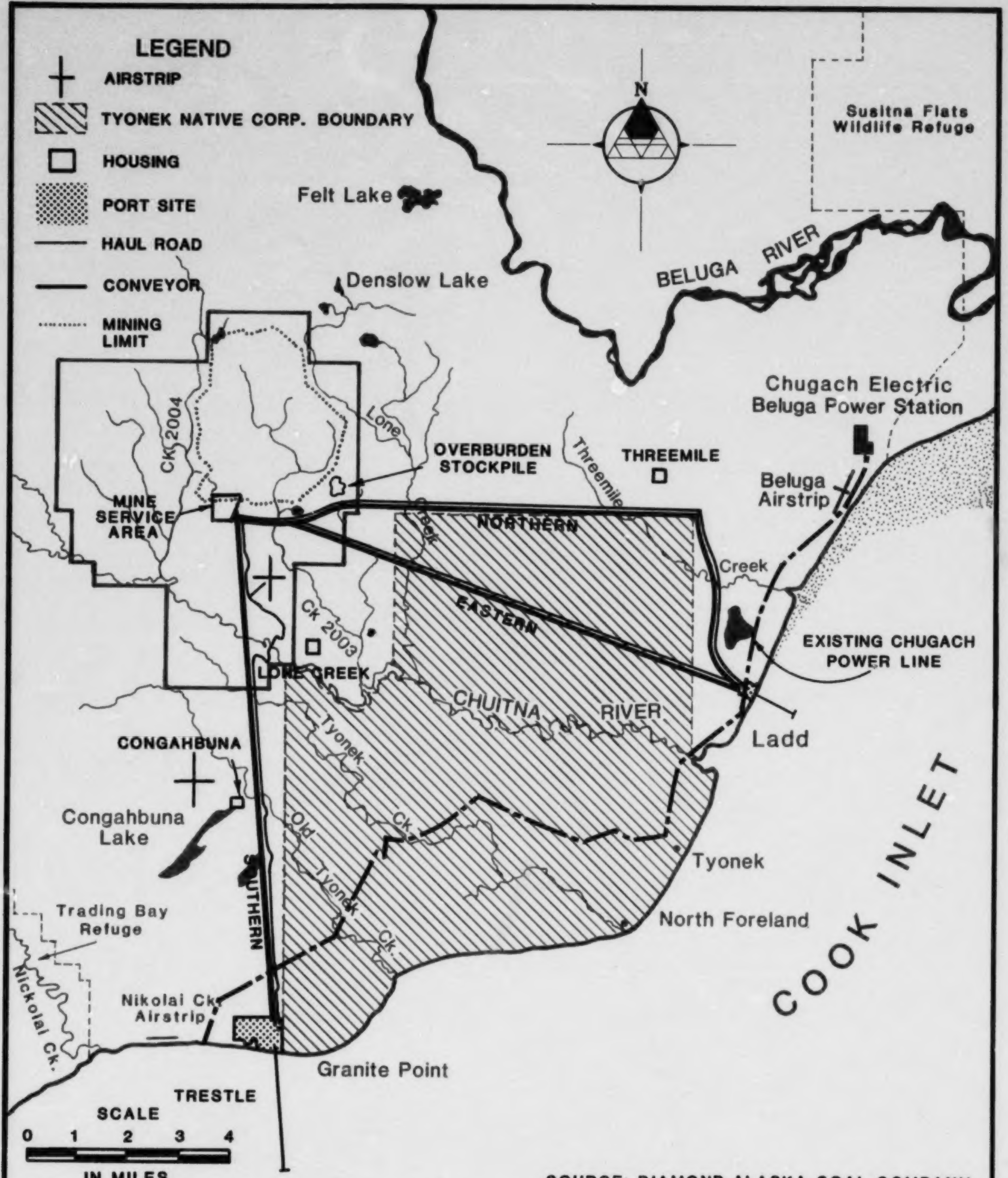
The project overview below generally describes the project at full production. Most mine development impacts would be of lower magnitude before full production is reached. The exceptions would be short-term activities such as hauling coal by truck. This would occur only during the early years of the project and may cause greater impacts than transporting coal by conveyor.

2.2.2 Project Overview

Development of the Diamond Chuitna project would involve a surface coal mine located approximately 72 km (45 mi) west of Anchorage (Fig. 1-1). The coal would be strip mined by large shovels and draglines and hauled by trucks to a nearby mine area conveyor for transport to a mine service area for crushing. The crushed coal initially would be hauled in trucks from the mine service area to a port on Cook Inlet. After two years of mine operation, coal would be moved from the mine service area to the port on a conveyor. At lower production levels, the coal would be loaded from a short trestle at the port onto barges for transport to market. At higher production levels, coal would be loaded from a long trestle onto ships.

Under the optimal, four-year full production development schedule, production in the first year of mine operation would be approximately 1.8 million Mt (2 million short tons). Production would increase to about 3.6 Mt (4 million short tons) in the second year. In the third year, production would increase to approximately 5.4 million Mt (6 million short tons), reaching 10.9 million Mt (12 million short tons) per year by the fourth year of mine operation.

Figure 2-1 shows the locations of the project component options used to formulate the action alternatives. The mine, overburden stockpile, and mine service area all would be located on land owned by the State of Alaska (Fig. 4-1).


LEGEND
AIRSTRIP
TYONEK NATIVE CORP. BOUNDARY
HOUSING
PORT SITE
HAUL ROAD
CONVEYOR
MINING LIMIT
N
Felt Lake
Susitna Flats Wildlife Refuge
Denslow Lake
BELUGA RIVER
Chugach Electric Beluga Power Station
Lone Creek
Ck 2004
OVERBURDEN STOCKPILE
Threemile Creek
THREEMILE
Beluga Airstrip
MINE SERVICE AREA
NORTHERN
EASTERN
Ck 2003
LONE CREEK
EXISTING CHUGACH POWER LINE
CHUITNA RIVER
Ladd
CONGAHBUNA
Congahbuna Lake
Tyonek Ck.
Old Tyonek Ck.
Tyonek
COOK INLET
SOUTHERN
North Foreland
Trading Bay Refuge
Nickolai Ck.
Nikolai Ck Airstrip
Granite Point
TRESTLE
SCALE
0 1 2 3 4
IN MILES

SOURCE: DIAMOND ALASKA COAL COMPANY

FINAL PROJECT OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 2-1

There are three transportation corridor options: northern/Ladd, eastern/Ladd, and southern/Granite Point (Fig. 2-1). The northern corridor would run east from the mine service area across state land toward the Beluga airstrip, then turn south southeast across land owned by Cook Inlet Region Native Corporation to a port site at Ladd on land owned by the Kenai Peninsula Borough (KPB). The eastern corridor would run in a straight line southeast from the mine service area across state land and land owned by the Tyonek Native Corporation (TNC) to the same port site at Ladd. The southern corridor would run in a straight line south from the mine service area across state and KPB land to a port site on state land at Granite Point. The Lone Creek and Threemile housing sites are located on state land, while the Congahbuna housing site and airstrip are located on KPB land.

2.2.3 Project Components and Options

In reviewing this document, it is important that the reader understand the relationship among the terms "component", "option", and "alternative." The project has several components, each one a necessary part of an entire viable mining project (e.g., the mine, transportation system, port site, housing site, etc.). For each component there may be one or more options (e.g., a southern or a southeastern transportation corridor location option). An alternative is a combination of options (one for each component) that consititutes an entire functioning project.

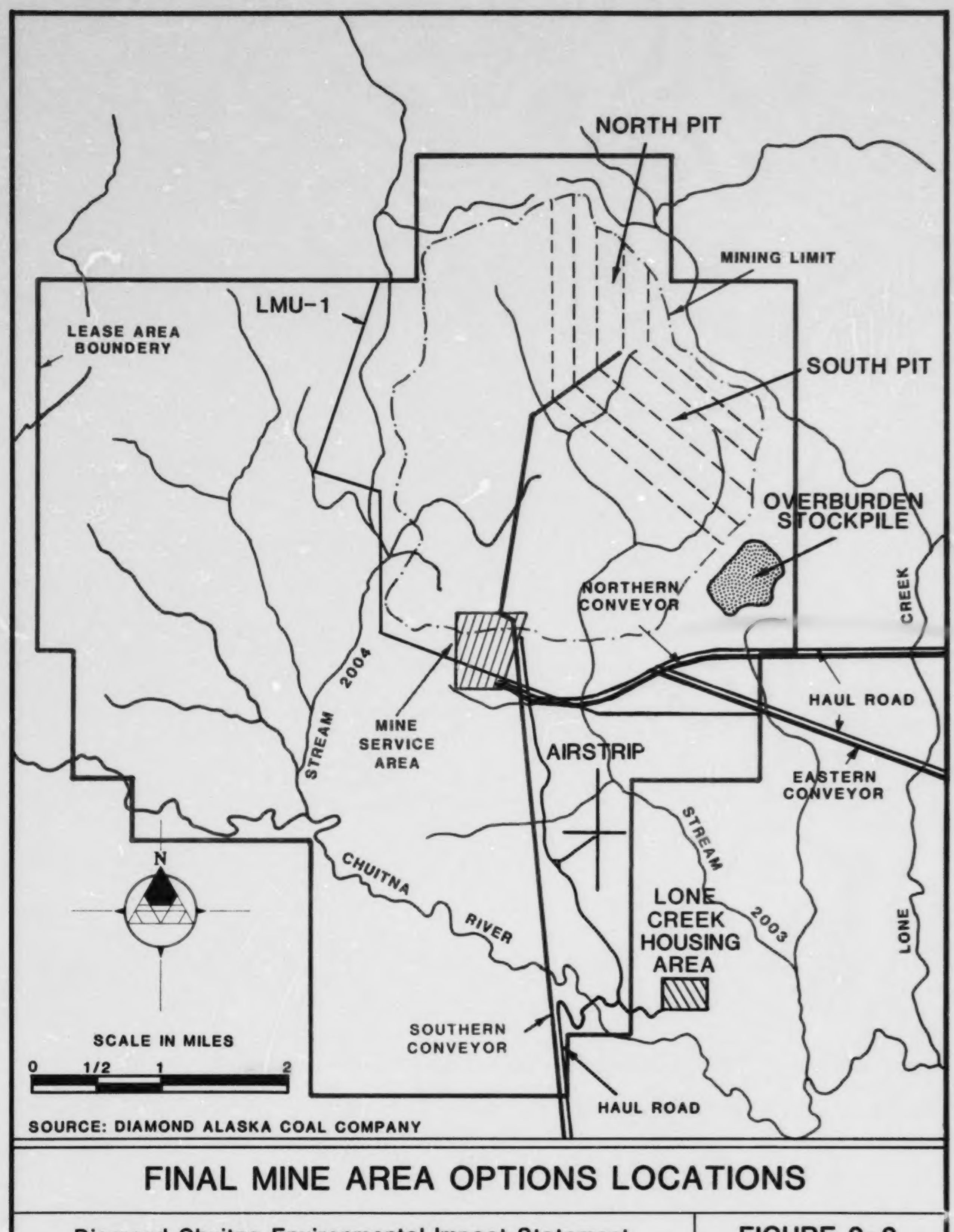
For most components the EIS scoping process initially identified at least two options. The process by which this large number of options was screened to reduce the number to a manageable level and how the ultimate project alternatives were selected is described in detail in Chapter 3.0. The descriptions below for each project component, therefore, address only those component options which were ultimately retained and which are specifically addressed in at least one of the action alternatives for each scenario. For each component where more than one option remains, the applicant's preferred option is described first.

2.3 MINE AREA FACILITIES

2.3.1 Location and Size

The mine would be located entirely within logical mining unit no. 1 (LMU-1), one of three units within the lease area and the only one involved in the proposed 34-year project (Fig. 2-2). LMU-1 covers approximately 4,047 ha (10,000 ac) and contains a minimum of 299 million Mt (330 million short tons) of coal.

The sizes and locations of the coal seams, the nature of the overburden* and interburden*, and the economics


NORTH PIT
MINING LIMIT
LMU-1
LEASE AREA BOUNDERY
SOUTH PIT
OVERBURDEN STOCKPILE
NORTHERN CONVEYOR
CREEK
HAUL ROAD
STREAM 2004
MINE SERVICE AREA
AIRSTRIP
EASTERN CONVEYOR
STREAM 2003
CHUITNA RIVER
LONE CREEK HOUSING AREA
LONE
N
SOUTHERN CONVEYOR
HAUL ROAD
SCALE IN MILES
0
1/2
1
2

SOURCE: DIAMOND ALASKA COAL COMPANY

FINAL MINE AREA OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 2-2

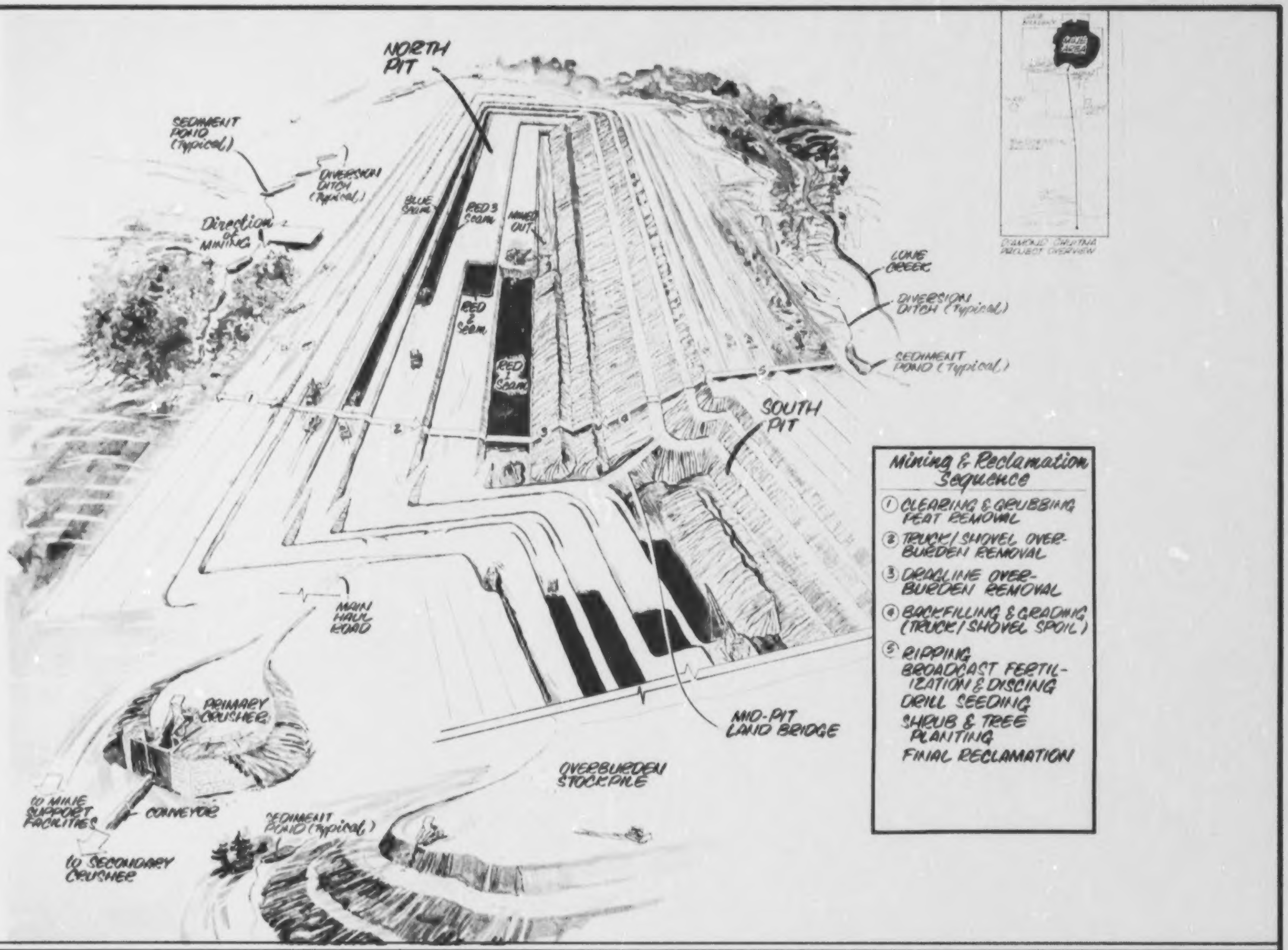
involved in mining the coal are such that only surface mining would be feasible. The coal is contained in five major seams, each varying in thickness between 1.8 and 6.1 m (6-20 ft), with a cumulative stripping ratio of 3.9:1 (i.e., 3.9 m^3 of overburden to 1 Mt of recoverable coal [4.6:1, or 4.6 yd^3 per short ton]). The actual area to be mined (mining limit) would be approximately 2,029 ha (5,014 ac) in size and would be divided into north and south pits (Fig. 2-2) which would be mined simultaneously but in separate operations during the life of the project. These pits would begin on the northeast edge of the mining limit and proceed generally west and southwest, respectively, during the life of the project.

A maximum of 182 ha (450 ac) of pit would be open at any one time. An additional maximum of 61 ha (150 ac) around the pit would be disturbed at any one time in clearing and grubbing vegetation in preparation for stripping overburden, or recontouring in preparation for revegetation. A total of approximately 63 ha (155 ac) per year would be cleared for mining in two periods - most likely spring and fall. Maximum depth of the pit would range from 6.1 m (20 ft) during the first year of production to approximately 122 m (400 ft) in the final years of the project. Average pit depth would be about 61 m (200 ft).

2.3.2 Mining Sequence and Methods

Mining activities would begin with the clearing and grubbing of all trees, brush, stumps, and other vegetation. This slash material would be burned, if conditions allowed, or buried under adequate spoil in the mine pit if burning were not possible. Topsoil would be removed and stored in a separate pile for use during revegetation. Then, approximately 16.8 million m^3 (22 million yd^3) of overburden, excluding topsoil, initially would be excavated (the "box cut"*) and permanently placed in an overburden stockpile (Fig. 2-2). After completion of the box cut, as new topsoil and overburden are excavated from the pit's advancing face to expose the coal, the overburden would be put onto the trailing edge of the pit from which the coal would have already been removed (Fig. 2-3). This area would then be reclaimed by regrading it to its approximate premining contours, including stream locations and drainages, covering it with topsoil, and then revegetating it. Because of an approximate 18 percent swell factor associated with the reclaimed overburden, the original surface contours could be approximated without use of the material in the permanent overburden stockpile.

During the first year of production, mining methods would employ shovels (15-19 m^3 [20-25 yd^3] capacity), overburden haul trucks (136-154 Mt [150-170 short ton] payloads), and coal haul trucks (91-136 Mt [100-150 short ton]) for stripping and coal recovery. A 44 m^3 (57 yd^3) dragline


NORTH PIT
SEDIMENT POND (Typical)
DIVERSION DITCH (Typical)
Direction of MINING
BLUE Seam
RED 3 Seam
MINED OUT
RED 2 Seam
RED 1 Seam
LONE CREEK
DIVERSION DITCH (Typical)
SEDIMENT POND (Typical)
SOUTH PIT
MAIN HAUL ROAD
PRIMARY CRUSHER
to MINE SUPPORT FACILITIES
CONVEYOR
to SECONDARY CRUSHER
SEDIMENT POND (Typical)
OVERBURDEN STOCKPILE
MID-PIT LAND BRIDGE
MINE AREA
DIAMOND CHUITNA PROJECT OVERVIEW
Mining & Reclamation Sequence
① CLEARING & GRUBBING PEAT REMOVAL
② TRUCK/SHOVEL OVER-BURDEN REMOVAL
③ DRAGLINE OVER-BURDEN REMOVAL
④ BACKFILLING & GRADING (TRUCK/SHOVEL SPOIL)
⑤ RIPPING
BROADCAST FERTILIZATION & DISCING
DRILL SEEDING
SHRUB & TREE PLANTING
FINAL RECLAMATION
1
2
3
5

ARTIST'S ILLUSTRATION –
MINING AND RECLAMATION SEQUENCE

Diamond Chuitna Environmental
Impact Statement

FIGURE 2–3

would be added later with a smaller 27 m^3 (35 yd^3) dragline added when full production was resumed. At full production capacity, the draglines would be used for overburden and interburden removal while the shovels and haul trucks would be used for prestripping of overburden.

Coal would be loaded onto trucks directly from the seams by hydraulic backhoes, shovels, or front end loaders. Because of the unconsolidated nature of both the overburden and interburden and the tendency of the coal to crumble, no major blasting is anticipated. Some infrequent secondary blasting would be required, primarily to move large glacial erratic boulders which are scattered throughout the overburden. Such blasting would occur an average of once per week.

Run-of-the-mine coal would be hauled by truck to a primary crusher located in front of the advancing mine face between the north and south pits (Fig. 2-3). The primary crusher would be moved every three to five years. The coal would be crushed to a maximum size of 15 cm (6 in) and carried about 3,962 m (13,000 ft) by a 1.4 m (54 in), two-span partially enclosed mine area conveyor system to a secondary crusher (located in the mine service area outside the mining limit) where it would be crushed to a maximum size of 5 cm (2 in) and then weighed. The mine area conveyor would be elevated in at least four locations so that the bottom of the horizontal steel support pipe would be a minimum of 2.4 m (8 ft) above ground level to permit crossing by moose and bears.

2.3.3 Water Control and Treatment

The discussion below summarizes the major aspects of the proposed water drainage control and treatment system. More detailed information may be found in Vol. XVII, Sec. 4.12, of the state surface mine permit application (Diamond Alaska Coal Company 1985). The two water control processes needed in the mine area to handle surface and ground-water flows both within and around the active mine pit are described below. During the initial 10 years of operation, portions of streams 200304 and 200305 would be mined and a sediment pond would be located in stream 200305. A major portion of stream 2003 (Fig. 2-2) would be displaced during the later years of the project.

2.3.3.1 Runoff from Areas Outside the Active Mine Pit

The area to be mined during initial 10 years of operation is topographically situated such that it would receive little natural runoff from surrounding undisturbed areas. Thus, little runoff would have to be diverted around the mining area for discharge into existing drainages.

The primary collection ditch and sediment pond system for runoff from within the area to be mined would be constructed prior to mining and would be maintained until completion of reclamation (Fig. 2-4). Note that this system covers only the first 10 years of operation (7 years of mining). The collection ditches would carry runoff from disturbed and undisturbed areas within the area to be mined, the overburden stockpile, and mine service area to sediment ponds. These ponds would function by retaining the water to allow suspended solids to settle out prior to discharge to existing drainages. Depending upon the location, amount and quality of the collected water, it might also be handled or controlled by various other methods including sediment treatment structures, dugout pond/filter dams, sediment filter fabrics, gravel pads, and vegetation barriers.

All discharges would meet applicable water quality standards. Where other treatment was necessary before discharge, e.g., flocculation, additional treatment facilities would be built in conjunction with the sediment ponds. Figure 2-5 shows a typical two-structure sediment pond system with flocculant building. The collection ditch/sediment pond system would be redesigned and rebuilt at intervals to accommodate drainage needs using the experience gained during the first 10 years of operation.

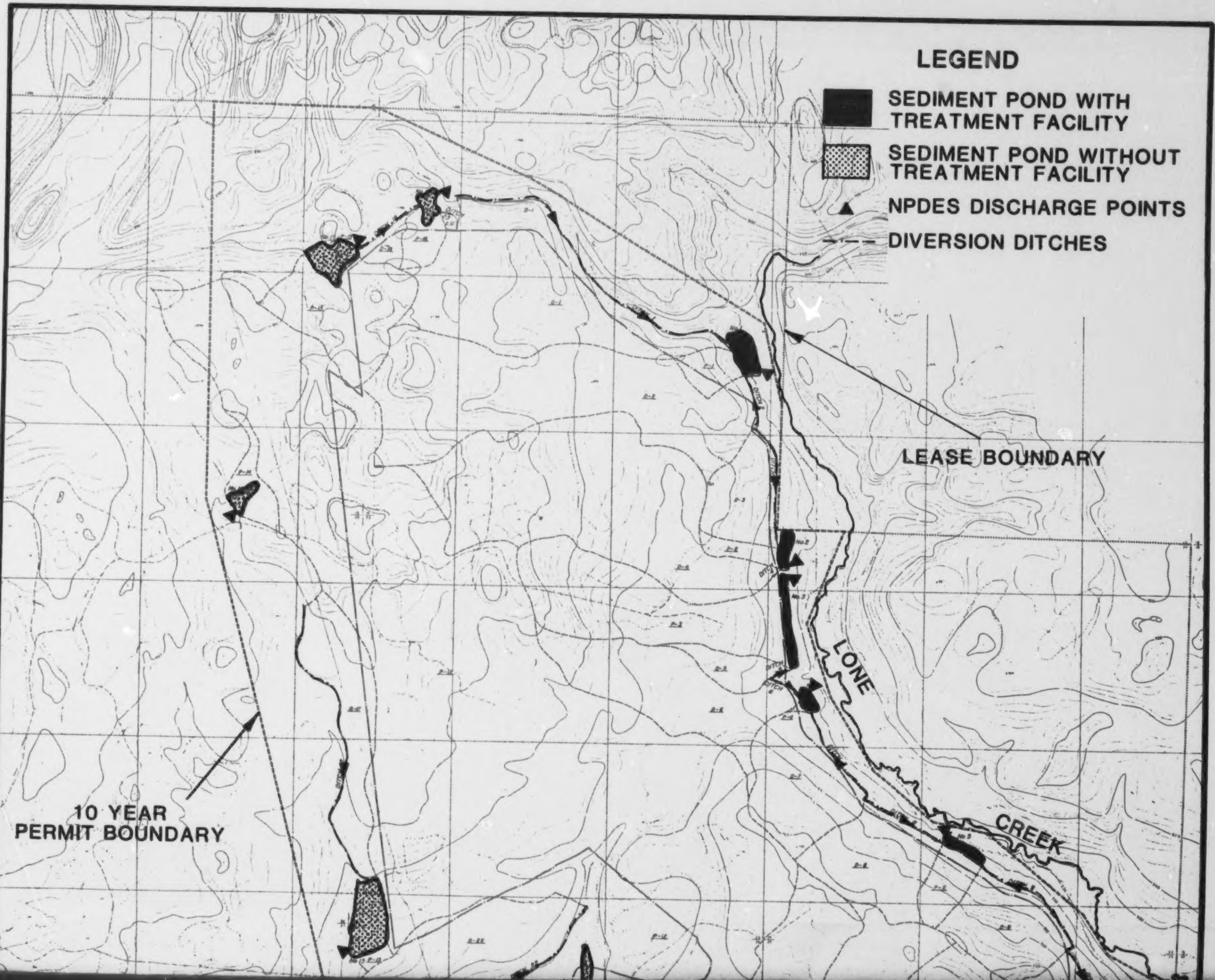
On the northwestern and western sides of the mine area, space is available for location of adequately sized sediment ponds to handle sediment loads with little or no additional treatment. However, on the northeastern and eastern sides of the mine area, space would be limited between the mine pit and Lone Creek. In these areas, sediment ponds with additional sediment treatment structures would be necessary during periods of high runoff. These treatment structures would consist of a series of excavations and embankments using baffles and selective routing to control, treat, and allow monitoring of runoff prior to discharge into Lone Creek.

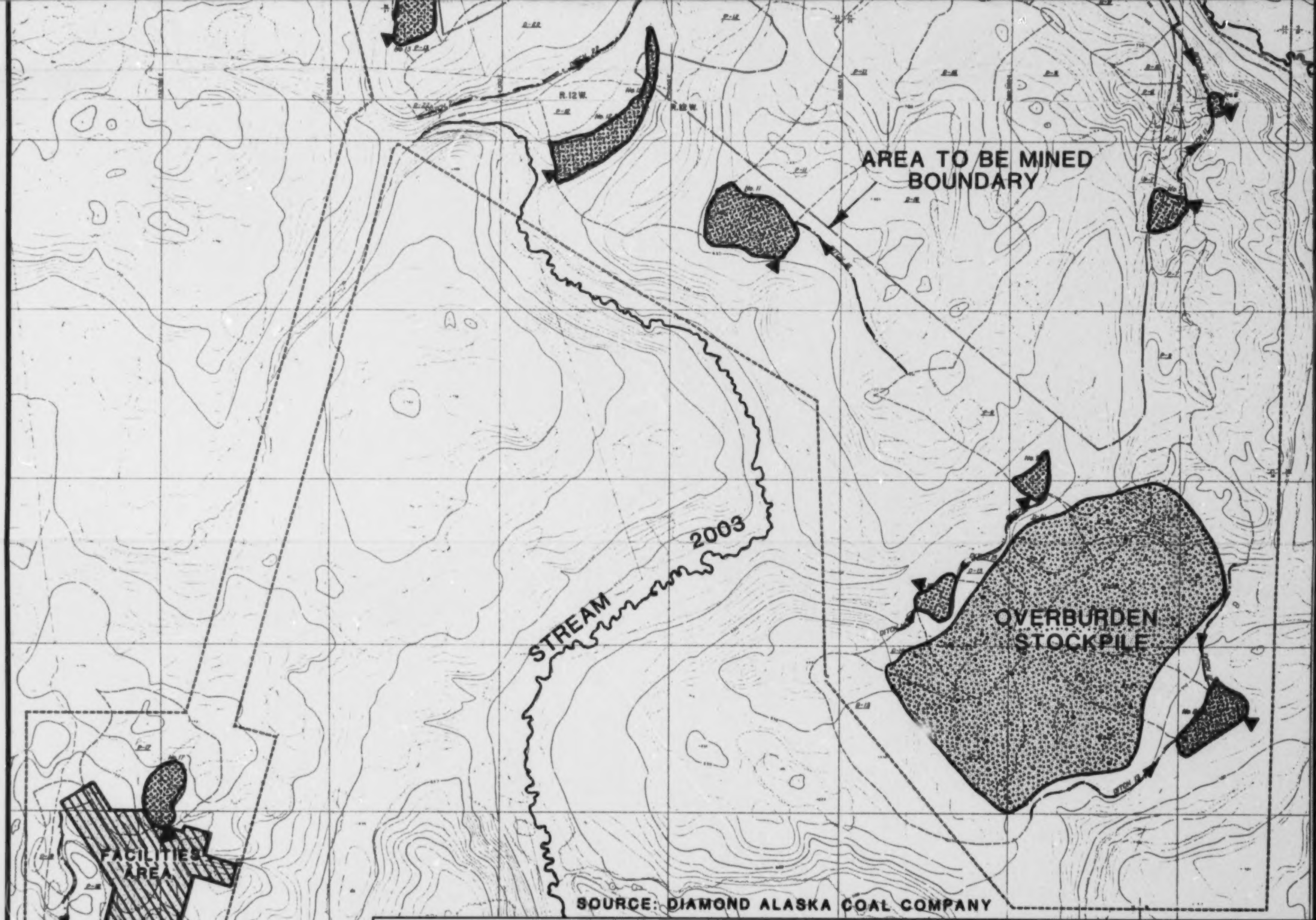
Once the water is treated, it would be released from the ponds into natural drainages at the 18 points shown in Figure 2-4. Outflow from sediment pond concrete spillways would be controlled by a riprap energy dissipator to minimize potential erosion.

The sediment ponds would be dredged periodically with the dredged material put into the mine pit and covered by at least 1.2 m (4 ft) of nontoxic spoil material.

2.3.3.2 Active Mine Pit Water

Control of surface runoff from rainfall and snowmelt within the active mine pit and ground water that would drain into the pit during the mining process would be handled in the same manner. Water would be collected in sumps* with a reserve storage capacity to allow initial settling of suspended solids and any additional treatment which might be


LEGEND
SEDIMENT POND WITH TREATMENT FACILITY
SEDIMENT POND WITHOUT TREATMENT FACILITY
NPDES DISCHARGE POINTS
DIVERSION DITCHES
LEASE BOUNDARY
LONE
CREEK
10 YEAR PERMIT BOUNDARY



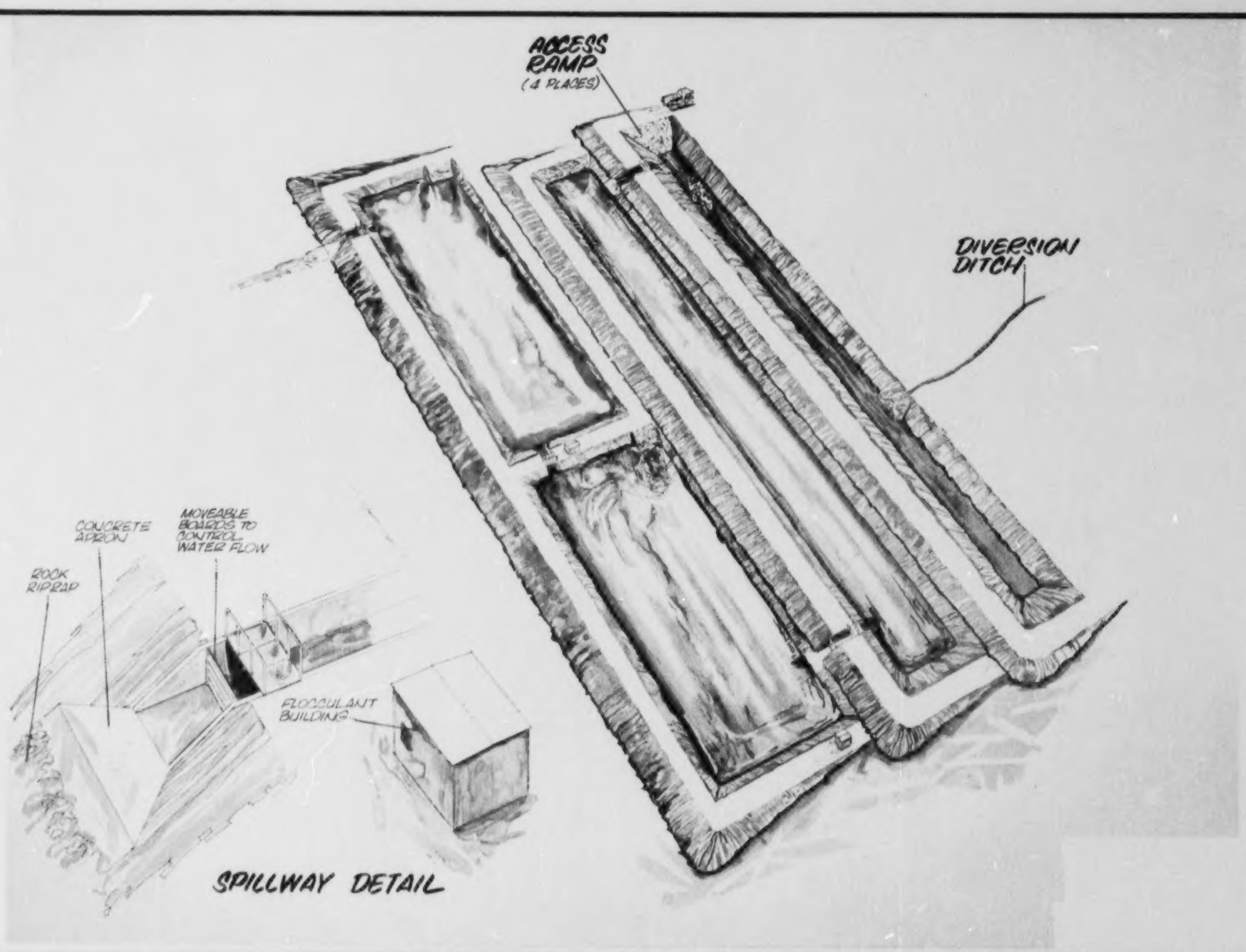
AREA TO BE MINED BOUNDARY
R.12 W.
STREAM 2003
OVERBURDEN STOCKPILE
FACILITIES AREA

SOURCE: DIAMOND ALASKA COAL COMPANY

MINE AREA DRAINAGE CONTROL AND TREATMENT FACILITIES

Diamond Chuitna Environmental Impact Statement

FIGURE 2-4


ACCESS RAMP (4 PLACES)
DIVERSION DITCH
CONCRETE APRON
MOVEABLE BOARDS TO CONTROL WATER FLOW
ROCK RIPRAP
FLOCCULANT BUILDING
SPILLWAY DETAIL

ARTIST'S ILLUSTRATION - TYPICAL SEDIMENT POND

Diamond Chuitna Environmental Impact Statement

FIGURE 2-5

necessary (e.g., buffering, flocculation). The water would then be pumped from the active mining areas to the adjacent larger sediment control ponds for treatment, monitoring, and discharge into drainages of Lone Creek and stream 2003. During a given year (within the first 10 years), approximately 50 percent of the water pumped from the active mine pit ultimately would be discharged into the Lone Creek drainage. At any time, however, discharges into either creek, or both simultaneously, could occur depending upon the active mining pit location.

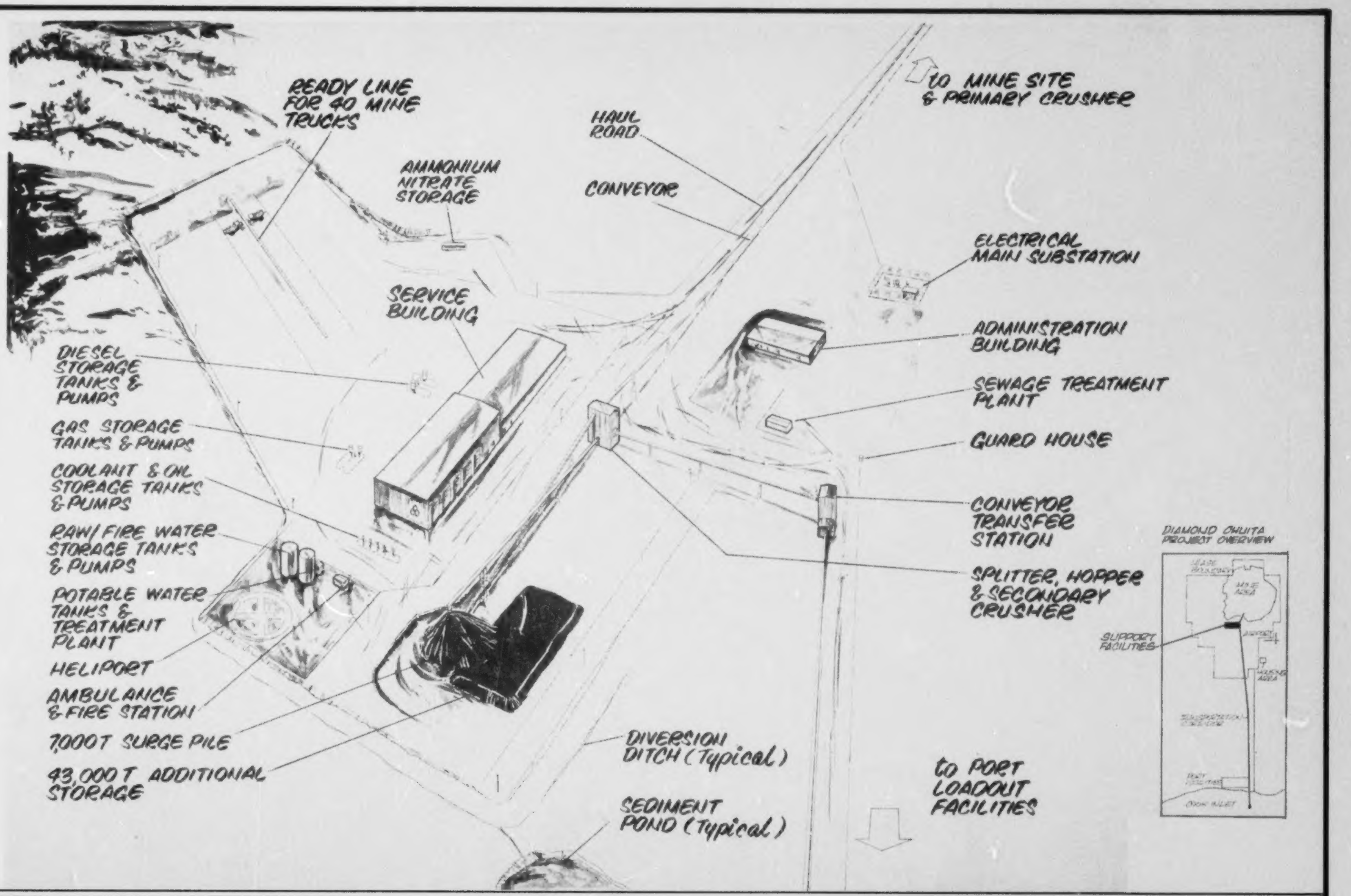
2.3.4 Overburden Stockpile

At the start of operations, approximately 16.8 million m^3 (22 million yd^3) of overburden from the box cut (excluding topsoil) would be excavated and permanently placed in an overburden stockpile (Fig. 2-2). Because of an approximate 18 percent swell factor associated with the reclaimed overburden, the original surface contours could be duplicated without use of the material in the permanent overburden stockpile. This stockpile would be approximately 61 m (200 ft) high, 1,280 m (4,200 ft) long and 670 m (2,200 ft) wide and would cover about 81 ha (200 ac). No further material would be added. The stockpile would be stabilized, graded and then revegetated to prevent erosion. Runoff from the stockpile would be handled in the same manner as described above for the mine area using a treatment system consisting of collection ditches and three sediment ponds (Fig. 2-4). Topsoil from the box cut would be stockpiled in a separate area.

2.3.5 Mine Service Area

The permanent mine service area would be located on the southern edge of the mining limit (Fig. 2-2). The approximately 22 ha (55 ac) area would include the main administration building, a service building housing the principal maintenance, warehouse and service facilities; equipment ready lines; water, diesel fuel, gasoline and lubricant storage; electrical substation; ambulance and fire station; water and sewage treatment plants; emergency power system; explosives magazine; heliport; and emergency and safety facilities (Fig. 2-6). The area would not be fenced. No one would be housed at the mine service area.

Coal from the primary crusher at the mine would enter the mine service area by conveyor and pass through a splitter-hopper* which would feed coal to either the secondary crusher (and thence by conveyor to the port) or to a surge pile or an emergency storage pile in the service area. The coal would not be washed or otherwise processed. The two coal piles would have a combined capacity of approximately 45,360 Mt (50,000 short tons) and would serve to offset differences in conveyor capacities and compensate for downtime in mining operations.


READY LINE FOR 40 MINE TRUCKS
AMMONIUM NITRATE STORAGE
HAUL ROAD
CONVEYOR
to MINE SITE & PRIMARY CRUSHER
SERVICE BUILDING
ELECTRICAL MAIN SUBSTATION
ADMINISTRATION BUILDING
DIESEL STORAGE TANKS & PUMPS
GAS STORAGE TANKS & PUMPS
SEWAGE TREATMENT PLANT
GUARD HOUSE
COOLANT & OIL STORAGE TANKS & PUMPS
CONVEYOR TRANSFER STATION
RAW/FIRE WATER STORAGE TANKS & PUMPS
SPLITTER, HOPPER & SECONDARY CRUSHER
POTABLE WATER TANKS & TREATMENT PLANT
HELIPORT
AMBULANCE & FIRE STATION
7,000T SURGE PILE
43,000 T ADDITIONAL STORAGE
DIVERSION DITCH (Typical)
SEDIMENT POND (Typical)
to PORT LOADOUT FACILITIES
DIAMOND CHUITA PROJECT OVERVIEW
LEASE BOUNDARY
MINE AREA
SUPPORT FACILITIES
AIRPORT
HOUSING AREA
TRANSPORTATION CORRIDOR
PORT FACILITIES
COOK INLET

ARTIST'S ILLUSTRATION – MINE SERVICE AREA

Diamond Chuitna Environmental Impact Statement

FIGURE 2-6

Runoff from the mine facilities area itself, including any water used for dust control spraying, would be collected by a ditch system and sent to two sediment ponds (Fig. 2-4) for settling and treatment to meet water quality standards before being released into the stream 2003 drainage.

Sanitary waste water generated at the facility would be treated in a packaged treatment plant at primary and secondary levels. Effluent would be carried in a pipeline buried next to the road to the housing area where it would join the treated effluent pipeline from the housing site and be discharged into the Chuitna River directly south of the housing site.

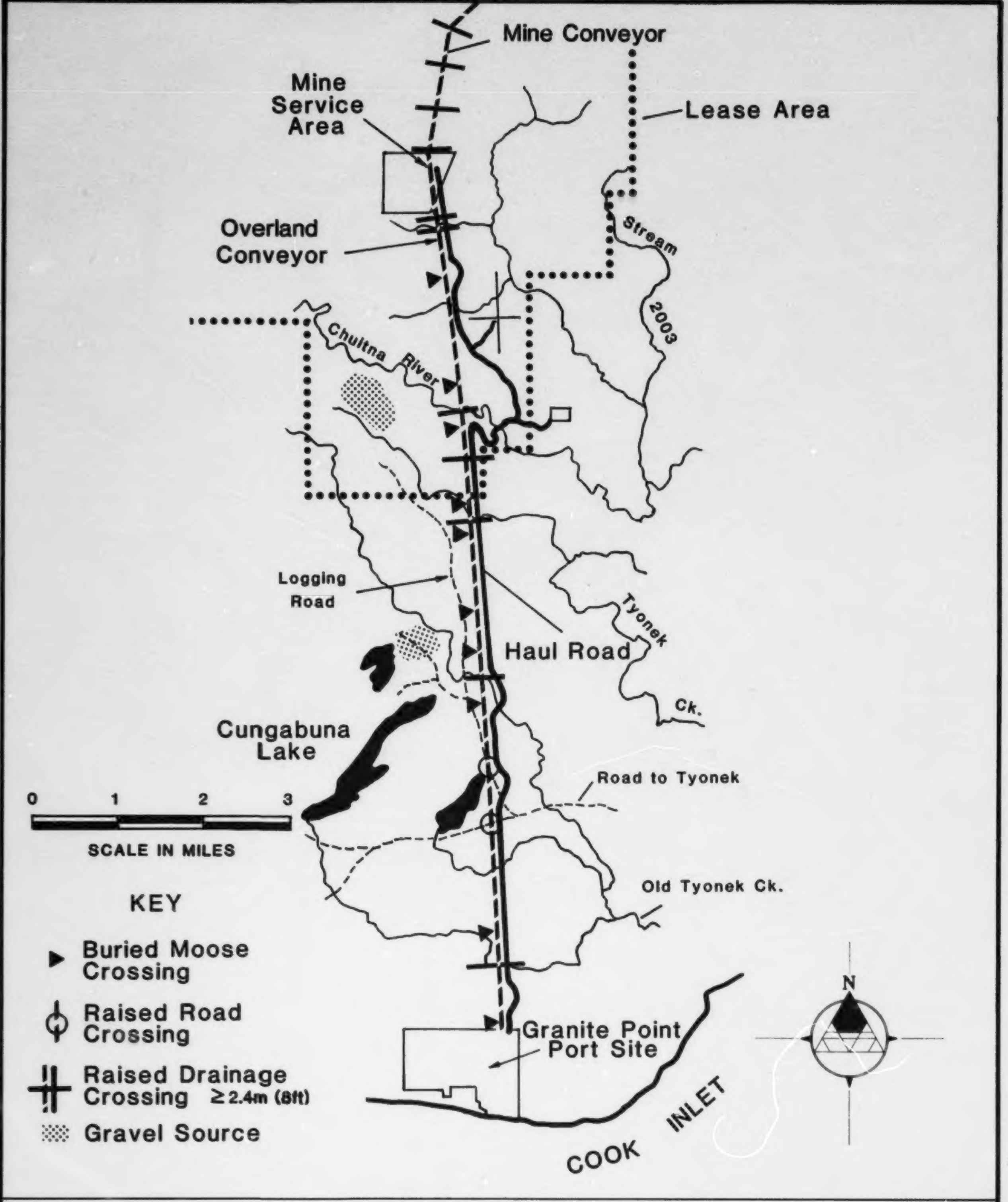
Nonorganic solid wastes would be deposited in fenced and enclosed dumpsters located throughout the service area and collected on a regular basis. A temporary fenced landfill near the mine site would be used for solid waste disposal only during construction, and would then be closed. After that, these wastes would be trucked to a large, permanent, fenced disposal site in the vicinity of the mine. Solid wastes would not be put into the mine pit itself. Organic wastes would be deposited in separate fenced and enclosed dumpsters within the service area and hauled to the housing area organic waste incinerator. Hazardous wastes would be handled completely separately and would be removed from the project area entirely for disposal at an authorized hazardous waste site.

2.4 TRANSPORTATION SYSTEM

2.4.1 Conveyor

If either the southern or eastern transportation corridor is selected, an approximatley 17.6 km (11 mi) single-span conventional continuous belt conveyor would transport coal from the mine service area to a port on Cook Inlet (Figs. 2-7 and 2-8). The northern corridor would require an approximately 22 km (13.8 mi) two-span conveyor (Fig. 2-9). The southern corridor would have six minor stream crossings (two unnamed tributaries to stream 2003 north of the Chuitna River, Tyonek Creek, Old Tyonek Creek, and two unnamed tributaries to Old Tyonek Creek) and one major stream crossing (Chuitna River). The northern corridor would also cross six small streams including two tributaries to stream 2003, Lone Creek, two tributaries to Threemile Creek, and the Threemile Creek mainstem. The eastern corridor would cross 3-4 streams including two tributaries to stream 2003 and Lone Creek.

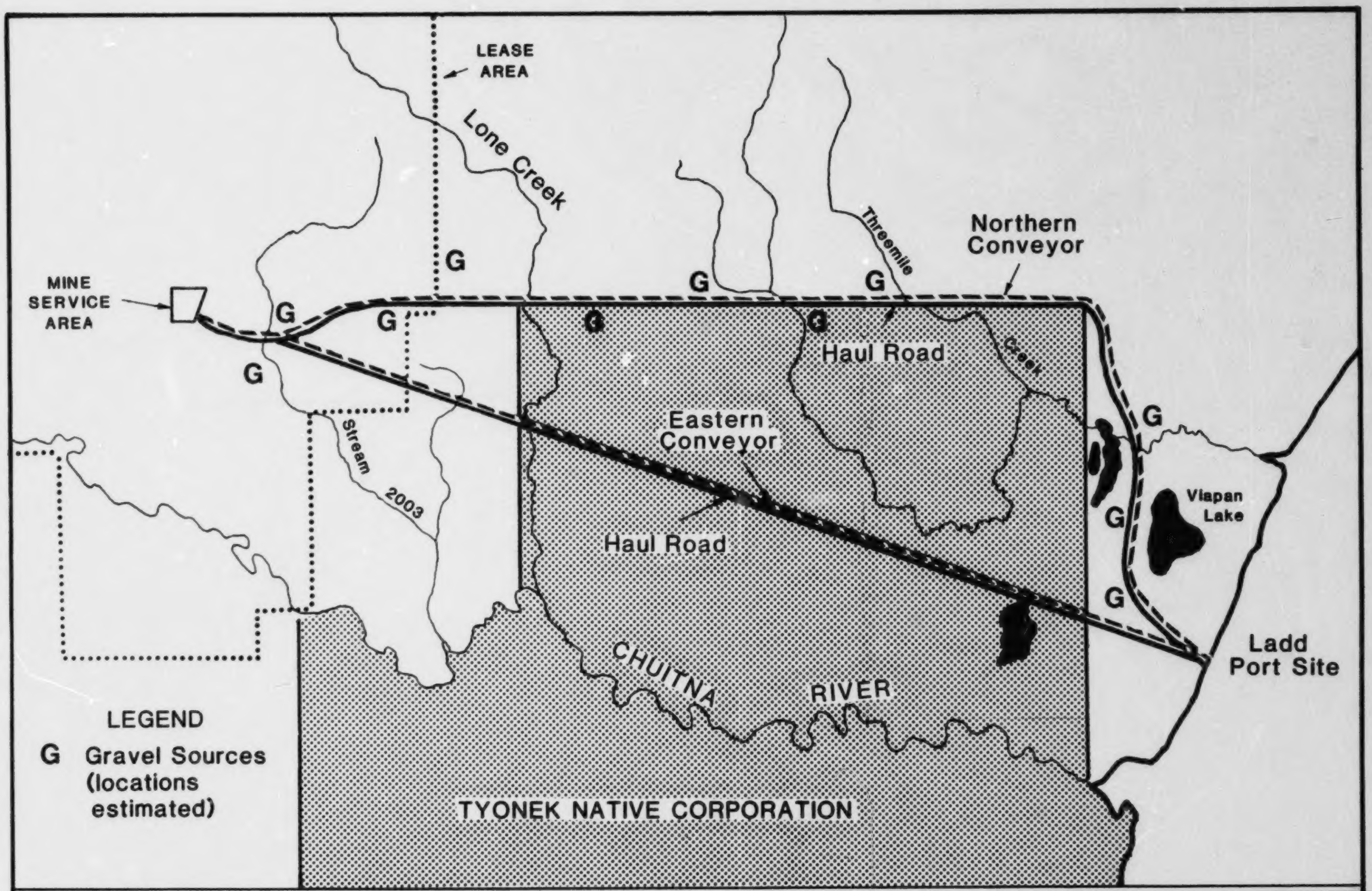
The entire conveyor structure would be supported by a horizontal steel pipe typically elevated about 0.6 m (2 ft) above the ground surface on pedestal support piers spaced approximately 6.1 m (20 ft) apart (Figs. 2-9 and 2-10). The entire structure typically would be 2.9 m (9.6 ft) tall and


Mine Conveyor
Mine Service Area
Lease Area
Overland Conveyor
Stream 2003
Chuitna River
Logging Road
Tyonek Ck.
Haul Road
Cungabuna Lake
Road to Tyonek
0 1 2 3
SCALE IN MILES
Old Tyonek Ck.
KEY
Buried Moose Crossing
Raised Road Crossing
Raised Drainage Crossing ≥2.4m (8ft)
Gravel Source
Granite Point Port Site
N
COOK INLET

SOUTHERN CORRIDOR CONVEYOR AND HAUL ROAD LOCATIONS

Diamond Chuitna Environmental Impact Statement

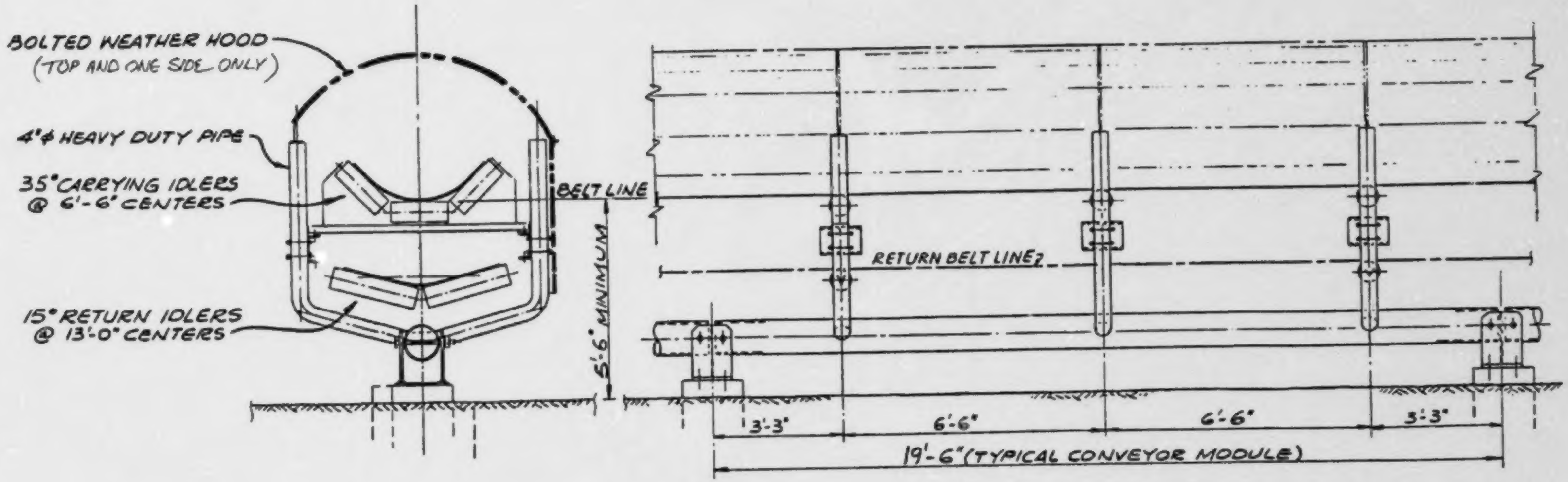
FIGURE 2-7


LEASE AREA
Lone Creek
Threemile
Creek
Northern Conveyor
MINE SERVICE AREA
G
Haul Road
Eastern Conveyor
Haul Road
Stream 2003
Viapan Lake
Ladd Port Site
CHUITNA RIVER
TYONEK NATIVE CORPORATION
LEGEND
G Gravel Sources (locations estimated)

EASTERN AND NORTHERN CONVEYOR AND ACCESS/HAUL ROAD LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 2-8

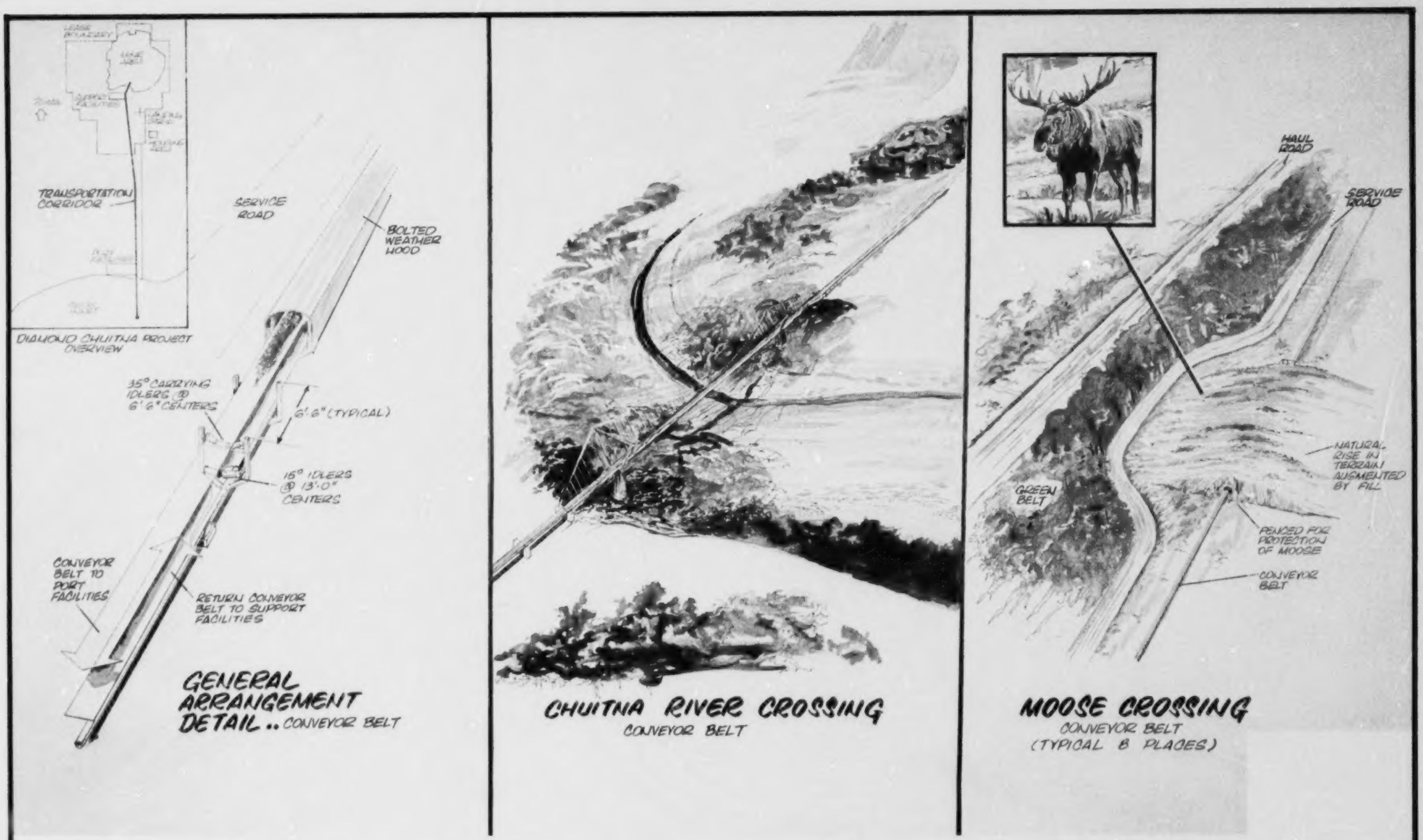

BOLTED WEATHER HOOD
(TOP AND ONE SIDE ONLY)
4"ϕ HEAVY DUTY PIPE
35° CARRYING IDLERS
@ 6'-6' CENTERS
15° RETURN IDLERS
@ 13'-0" CENTERS
BELT LINE
5'-6" MINIMUM
RETURN BELT LINE
3'-3"
6'-6"
6'-6"
3'-3"
19'-6" (TYPICAL CONVEYOR MODULE)

SOURCE: Diamond Alaska Coal Company

TYPICAL CONVEYOR MODULE
AND CROSS SECTION

Diamond Chuitna Environmental
Impact Statement

FIGURE 2-9


LEASE BOUNDARY
MINE AREA
SUPPORT FACILITIES
TRANSPORTATION CORRIDOR
DIAMOND CHUITNA PROJECT OVERVIEW
SERVICE ROAD
BOLTED WEATHER HOOD
35° CARRYING IDLERS @ 6'6" CENTERS
6'6" (TYPICAL)
15° IDLERS @ 13'-0" CENTERS
CONVEYOR BELT TO PORT FACILITIES
RETURN CONVEYOR BELT TO SUPPORT FACILITIES
HAUL ROAD
SERVICE ROAD
NATURAL RISE IN TERRAIN AUGMENTED BY FILL
GREEN BELT
FENCED FOR PROTECTION OF MOOSE
CONVEYOR BELT

GENERAL ARRANGEMENT DETAIL .. CONVEYOR BELT

CHUITNA RIVER CROSSING
CONVEYOR BELT

MOOSE CROSSING
CONVEYOR BELT
(TYPICAL 8 PLACES)

ARTIST'S ILLUSTRATION –
CONVEYOR SYSTEM DESIGN

Diamond Chuitna Environmental
Impact Statement

FIGURE 2-10

2.2 m (7.3 ft) wide. The coal-carrying belt would be a minimum of 1.7 m (5.5 ft) above the ground and would be supported by heavy duty pipe yokes attached to the horizontal steel pipe at 2 m (6.5 ft) intervals. The conveyor belt would be 1.2 m (48 in) wide and capable of moving about 1,633 Mt (1,800 short tons) of coal per hour. The conveyor belt would be enclosed on top and one side with a weatherhood to protect the coal from moisture and to reduce coal dust emissions from wind. The open side would permit access to the rollers for maintenance purposes. Wherever the conveyor crosses streams, it would be partially enclosed on the underside (underpanning) to prevent coal or dust from entering the stream. If a conveyor were built across the Chuitna River (southern corridor), it would be totally enclosed and suspended about 52 m (170 ft) above the river by cables (Fig. 2-9).

To permit moose, bears, and people to cross the conveyor, at appropriate locations it would be buried for a minimum of 61 m (200 ft) in large diameter culverts or arch spans (Fig. 2-10). At other locations, e.g., stream crossings, the conveyor would be elevated a minimum of 2.4 m (8 ft) above ground level. There would also be places where the conveyor would be raised to permit existing roads to pass underneath (Fig. 2-7). The conveyor would be gradually elevated to a clearance of 9.4 m (30 ft) at these road crossings, taking about 61 m (200 ft) on each side of the road to rise to that height from its normal elevation. In combination along any corridor, the maximum distance between crossings (underpass or overpass) would be approximately 2,000 m (2,187 yd), with an average center-to-center distance between crossings of approximately 880 m (962 yd).

While the specific locations for the conveyor crossings have been identified for the southern corridor (Fig. 2-7), data are not available to permit such specificity for the northern and eastern corridors. Such crossings would be identified, as data become available, within the maximum distance criteria set out above.

A light duty, minimally improved 3.7 m (12 ft) service/access road suitable for four-wheel drive vehicles would be built immediately adjacent to the conveyor for maintenance purposes. It would be separated from the substantially improved access haul road primarily for safety reasons (to reduce risk of vehicle/conveyor collisions). The separation would also provide a greenbelt between the more heavily traveled access/haul road and the conveyor to increase ease of big game movements across the corridor. Drainage and sediment control measures for the conveyor would be the same as those described below for the main access/haul road. Brush within the conveyor right-of-way would be mechanically controlled; no herbicides would be used.

2.4.2 Access/Haul Road

A private, all-weather access/haul road would be constructed that would generally parallel the conveyor (Figs. 2-7 and 2-8). The road would be gravel surfaced, crowned to promote drainage, and would have two 10.7 m (35 ft) wide traffic lanes with 3.7 m (12 ft) wide gravel shoulders on each side (Fig. 2-11). Grades would be maintained at a maximum of 6 percent.

Over most of its length, the road would be separated from the conveyor by approximately 61 m (200 ft). At river crossings or other natural features, the road would have an independent alignment to maintain grade.

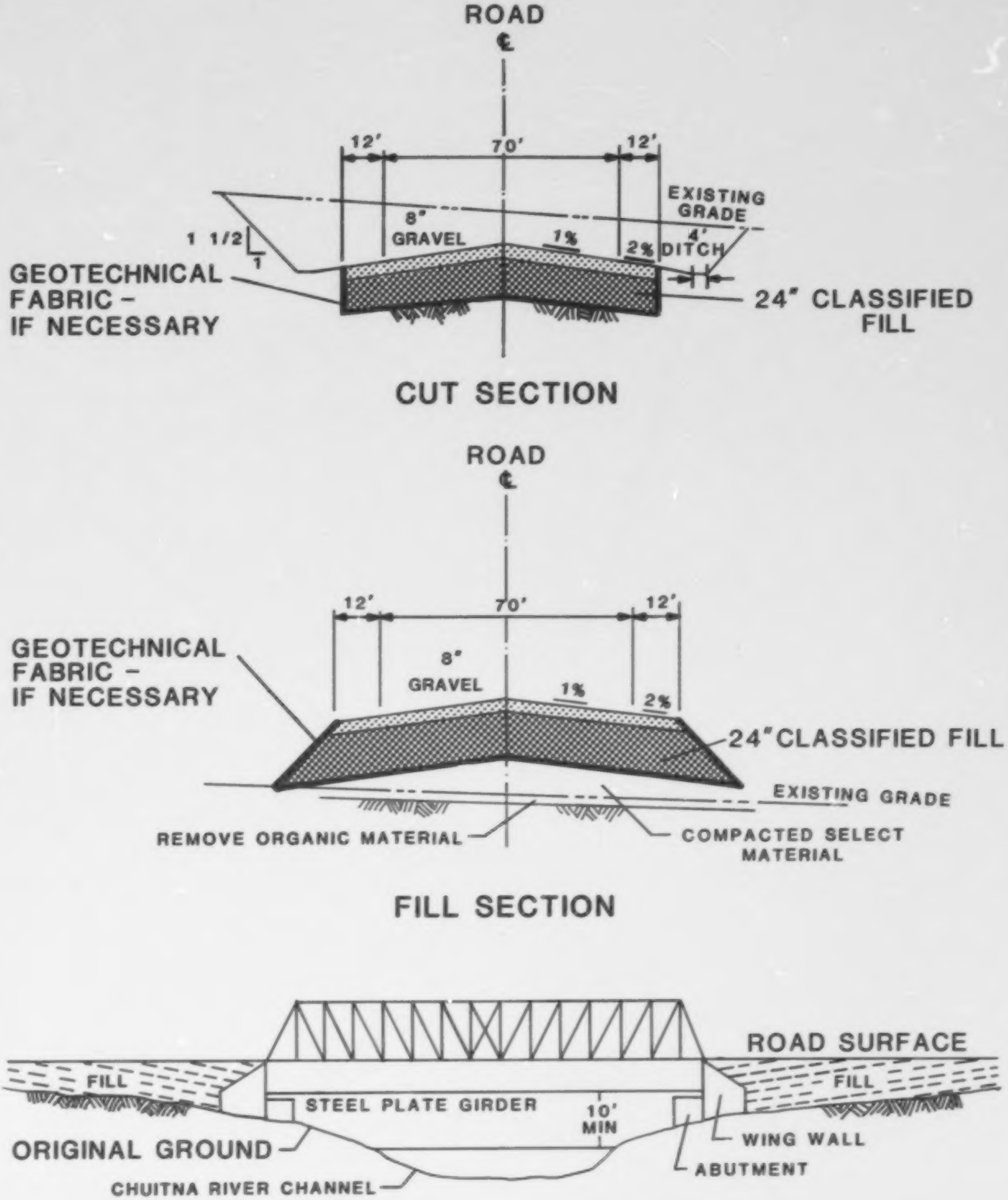
Drainage and sediment control measures would include: (1) construction of ditches to divert runoff from undisturbed areas around operational areas; (2) construction of collection ditches; (3) installation of culverts under roads to collect and control runoff from road surfaces, embankments, and adjacent areas; (4) surfacing of main roads and facility areas with gravel material; (5) revegetation of road cuts, embankments and other disturbed areas as soon as possible after construction; and (6) use of specific localized sediment control measures in sensitive areas. In sensitive areas such as those adjacent to stream channels, localized sediment control measures would include ditches with rock filter dams, gradient terraces with dugout filter ponds, rock drainage-ways, placement of sediment filter fabric, and use of straw or vegetative sediment filters.

2.5 PORT FACILITIES

2.5.1 Onshore Port Facilities

The onshore port facilities at either Ladd or Granite Point would ultimately be capable of accommodating an annual capacity of 10.9 million Mt (12 million short tons) of coal (Fig. 2-1). Either onshore site would occupy approximately 121 ha (300 ac) on the bluff above Cook Inlet. The site would be connected to a supply barge staging area at tidewater about 30 m (100 ft) below the bluff by a 7.3 m (24 ft) wide beach access road. Figure 2-12 is an artist's illustration of the port facilities if built at Granite Point. A facility at Ladd would be similar.

Major facilities at the onshore site would include a large service building, coal transfer station, sampling building (to sample coal heating value, moisture, ash and sulphur content), main electrical and control building, fire and ambulance building, electrical substation, water storage and treatment plant, sewage treatment plant, diesel fuel and gasoline storage and distribution area, and a heliport. The site would be fenced to minimize human/wildlife encounters. No one would be housed at the port site during project operations.

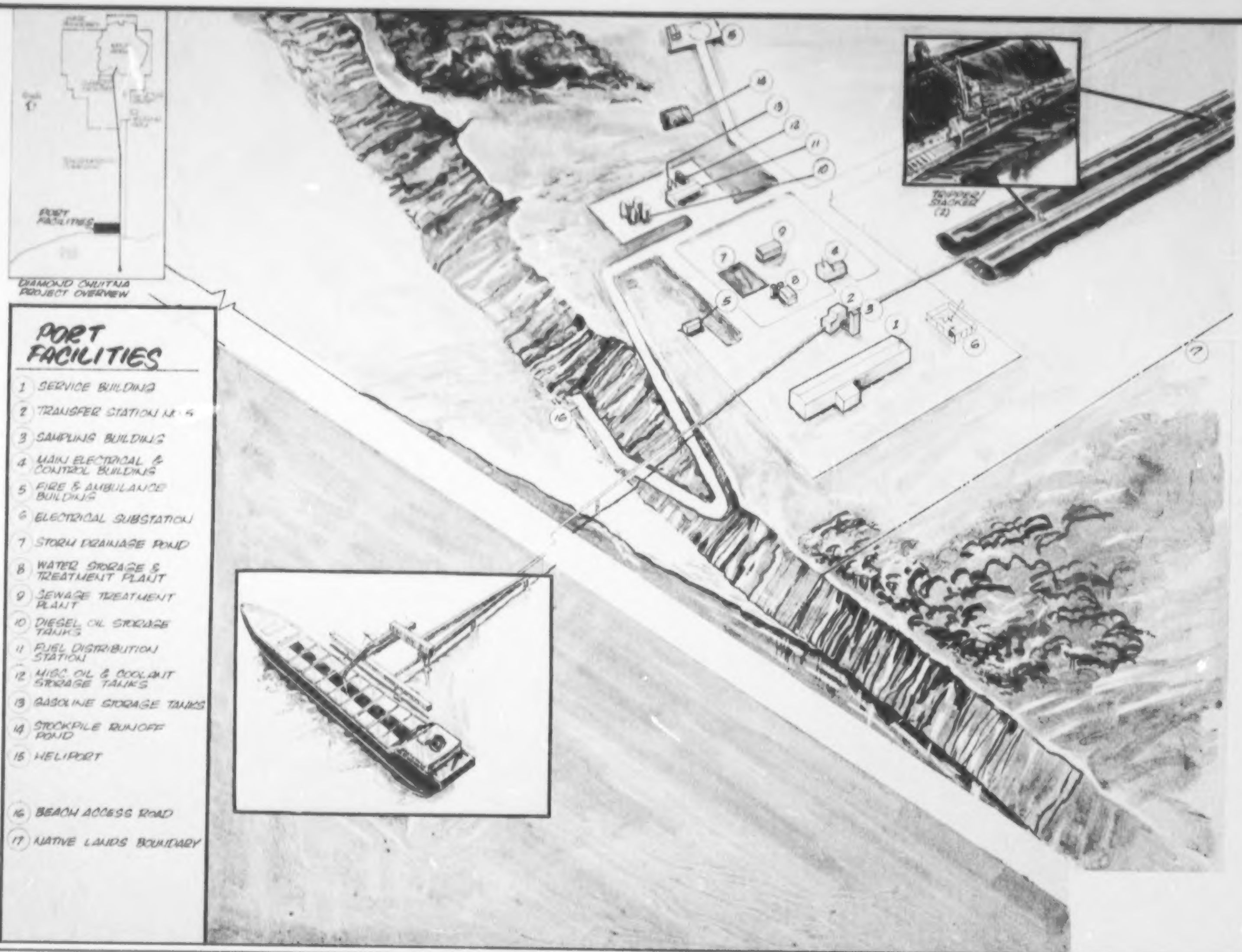

ROAD
℄
12'
70'
12'
EXISTING GRADE
8" GRAVEL
1 1/2
1
1%
2%
4' DITCH
GEOTECHNICAL FABRIC - IF NECESSARY
24" CLASSIFIED FILL
CUT SECTION
ROAD
℄
12'
70'
12'
GEOTECHNICAL FABRIC - IF NECESSARY
8" GRAVEL
1%
2%
24"CLASSIFIED FILL
EXISTING GRADE
REMOVE ORGANIC MATERIAL
COMPACTED SELECT MATERIAL
FILL SECTION
ROAD SURFACE
FILL
FILL
STEEL PLATE GIRDER
10' MIN
ORIGINAL GROUND
WING WALL
ABUTMENT
CHUITNA RIVER CHANNEL

SOURCE: DIAMOND ALASKA COAL CO.

TYPICAL HAUL ROAD AND BRIDGE DESIGN

Diamond Chuitna Environmental Impact Statement

FIGURE 2-11


PORT FACILITIES
DIAMOND CHUITNA PROJECT OVERVIEW
TRIPPER/ STACKER (2)
PORT FACILITIES
1 SERVICE BUILDING
2 TRANSFER STATION NO. 5
3 SAMPLING BUILDING
4 MAIN ELECTRICAL & CONTROL BUILDING
5 FIRE & AMBULANCE BUILDING
6 ELECTRICAL SUBSTATION
7 STORM DRAINAGE POND
8 WATER STORAGE & TREATMENT PLANT
9 SEWAGE TREATMENT PLANT
10 DIESEL OIL STORAGE TANKS
11 FUEL DISTRIBUTION STATION
12 MISC. OIL & COOLANT STORAGE TANKS
13 GASOLINE STORAGE TANKS
14 STOCKPILE RUNOFF POND
15 HELIPORT
16 BEACH ACCESS ROAD
17 NATIVE LANDS BOUNDARY

ARTIST'S ILLUSTRATION -
PORT SITE FACILITIES

Diamond Chuitna Environmental
Impact Statement

FIGURE 2- 12

Coal would enter the onshore port facility on the overland conveyor and be transferred to one of the two 1.8 m (72 in) yard conveyors. It would then be sent directly to the shiploader on the approach trestle if a barge or ship were being loaded. If loading were not in progress, coal would be stored in two large parallel stockpiles on either side of the conveyor (Fig. 2-12). The amount of coal stored at the port site would vary depending upon shipping schedules, marine weather conditions, and downtime in mining operations. At full production, up to 1.1 million Mt (1.2 million short tons) of coal could be stored, but a minimum of 90,720 Mt (100,000 short tons) always would be stockpiled. A 30 to 45 day turnover of coal in the stockpiles would be anticipated. Tests on the spontaneous combustion potential of the coal indicated no susceptibility to firing while exposed to the atmosphere. The coal piles would be unlined and would sit upon a gravel fill pad. Alignment of the piles would be approximately north-south at Granite Point to minimize contact with the prevailing winds. Alignment at Ladd has not yet been determined. The maximum dimensions of these stockpiles would be approximately 945 m (3,100 ft) by 61 m (200 ft) by 15 m (50 ft) high. During barge- or shiploading, coal would be taken from these stockpiles and placed on the conveyors to the approach trestle.

Coal would be transferred from the conveyor to the stockpiles, or taken from the stockpiles and placed onto the conveyor, by two large railmounted stacker-reclaimer units which would move parallel to the conveyor (Fig. 2-11). These machines would have a bucketwheel at the end of their booms which would be able to break through a frozen crust of coal up to 0.6 m (2 ft) thick when reclaiming coal for shiploading.

A packaged commercial sewage treatment plant would be used to treat all sewage generated at the port facility. Following treatment to meet applicable standards, the effluent would be carried by pipeline along the elevated trestle and discharged into Cook Inlet at Granite Point or discharged into an onsite leach field at Ladd.

Nonorganic solid wastes would be deposited in fenced and enclosed dumpsters located throughout the port facility and collected on a regular basis. Initially, these wastes would be hauled to a temporary fenced landfill near the mine site which would be closed following completion of construction. For the first five to ten years of project operation, these wastes would be buried in a fenced landfill near the port facility. After that, the wastes would be hauled to the large permanent landfill in the vicinity of the mine. Solid wastes would not be put into the mine pit itself. Organic wastes would be deposited in separate fenced and enclosed dumpsters within the port facility and hauled to the housing area organic waste incinerator. Hazardous wastes would be handled completely separately and would be removed from the project area entirely for disposal at an authorized hazardous waste site.

Drainage and sediment control would be accomplished by drainage ditches which would collect all surface runoff from the disturbed area of the port site and divert it into sediment ponds. This would include storm runoff and water sprayed on coal stockpiles for dust control. Treatment methods would vary depending upon the water quality of the runoff. Following treatment, the water would be carried by pipeline on the approach trestle for discharge directly into Cook Inlet. All discharges would meet state and federal water quality standards (see the draft NPDES permit - Appendix D). The drainage and treatment system would be designed to accommodate volumes from the 10-year, 24-hour precipitation event. Likewise, all culverts and diversion ditches would be designed to contain the peak flow from a 10-year, 24-hour event.

2.5.2 Offshore Port Facilities

If full production is anticipated, a port could be developed at either Granite Point or Ladd. At either location, a trestle could be built to the deep water needed for accommodation of large coal ships. For less than full production, coal would be loaded onto ocean-going barges. Barges can operate in shallower waters than can the coal ships. Appropriate depths can be reached substantially closer to shore at Ladd than at Granite Point; therefore, if bargeloading only is required, a port would be developed at Ladd.

Offshore facilities for either port location would consist of an approach trestle with ship breasting and mooring dolphins (Fig. 2-12). The trestle length at Granite Point would be either 2,277 m (7,470 ft) or 3,810 m (12,500 ft) depending on the size of the ships which would be used.

Approximately 287 m (940 ft) of either trestle would be upland of the mean high tide line, thus reducing the length of the trestle extending into the inlet. The trestle would be 7.9 m (26 ft) wide, 9.1 m (30 ft) high and supported by single piles up to 3.7 m (12 ft) in diameter. The piles would be approximately 122 m (400 ft) apart and the trestle would be a minimum of 6.1 m (20 ft) vertically above the water at mean higher high water (MHHW). The structure would be designed to withstand the greater than 9.1 m (30 ft) tides, 3.6 m/s (7 knot) currents and 1.1 m (42 in) thick ice floes of upper Cook Inlet. One of the mooring dolphins would support a helipad.

At Granite Point, smaller "Panamax class" vessels (54,432 to 72,576 Mt [60,000 to 80,000 dwt]) with drafts of 11.9 m (39 ft) capable of passing through the Panama Canal could be loaded at the shorter trestle with a berthing depth of 14 m (45 ft) at mean lower low water (MLLW). Larger vessels up to 108,864 Mt (120,000 dwt) would require the longer trestle with a berthing depth of between 15.2 and 18.2 m (50 and 60 ft).

At Ladd, to accommodate lower production levels, the 9,072 to 13,609 Mt (10,000 to 15,000 dwt) barges would require a trestle of approximately 168 m (550 ft) in length to reach a berthing depth of 1.2 m (4 ft) at MLLW. This would require tidally controlled berthing where barges would be moved into the dock, loaded and then moved away to take advantage of water depths at higher tide levels. At full production, the trestle would be approximately 3,505 m (11,500 ft) long to load large ships at a berthing depth up to 18.2 m (60 ft). The trestle specifications would be the same as described above for Granite Point.

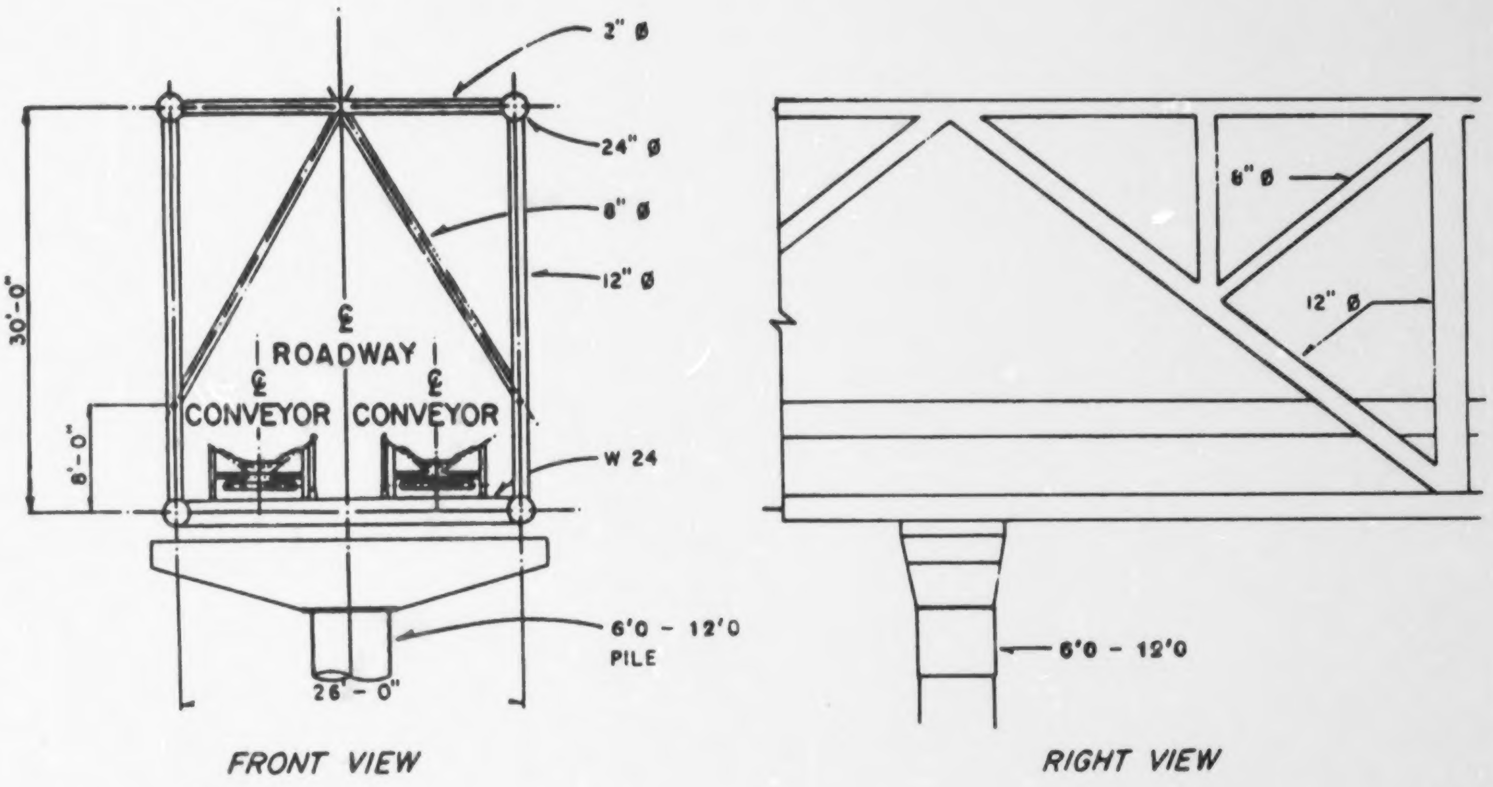
Coal would be transported from the onshore port to a linear shiploader facility at the end of the approach trestle on two covered conveyors each 1.8 m (72 in) wide (Fig. 2-13). At full production, the shiploader would have an effective loading rate of 3,629 to 4,536 Mt (4,000 to 5,000 short tons) per hour. It would have a boom capable of swinging to reach all compartments of a coal barge or ship, with the spout being lowered into the hold to reduce dust generation. The trestle conveyors would be paralleled by a 1.5 m (5 ft) wide walkway that would be used to transport operating and maintenance personnel and equipment. Coal could be loaded 24 hours per day throughout the year, affected only by weather and ice conditions in Cook Inlet.

The trestle would not be used for receiving supplies for the project. Freight, bulk materials, small quantities of certain fuels and other supplies would be brought in by barge, unloaded at the barge staging area on the beach, and trucked up the beach access road (Fig. 2-12) to the onshore port facility, housing site or the mine area as required. Major quantities of diesel fuel and gasoline would arrive by tanker and be pumped through a pipeline supported by the elevated trestle to the onshore port facility. Fuel would be stored in tanks at the onshore port site (which would hold a four-month supply) and be trucked by tractor/trailer units to the housing site or mine area as required (see Sect. 2.10.3). When ice conditions prohibited use of barges, food and miscellaneous supplies would be transported to the project area by aircraft.

2.6 HOUSING AND AIRPORT FACILITIES

2.6.1 Housing

The workforce would be housed in permanent single-status housing and community facilities on an 8 ha (20 ac) site. The entire housing area would be fenced to minimize human/animal contacts. Full production facilities would



2" Ø
24" Ø
8" Ø
12" Ø
W 24
6'0 - 12'0
PILE
30'-0"
8'-0"
26' - 0"
℄
ROADWAY
℄
CONVEYOR
℄
CONVEYOR
FRONT VIEW
8" Ø
12" Ø
6'0 - 12'0
RIGHT VIEW

SOURCE: Diamond Alaska Coal Company

TRESTLE AND PIER DESIGN

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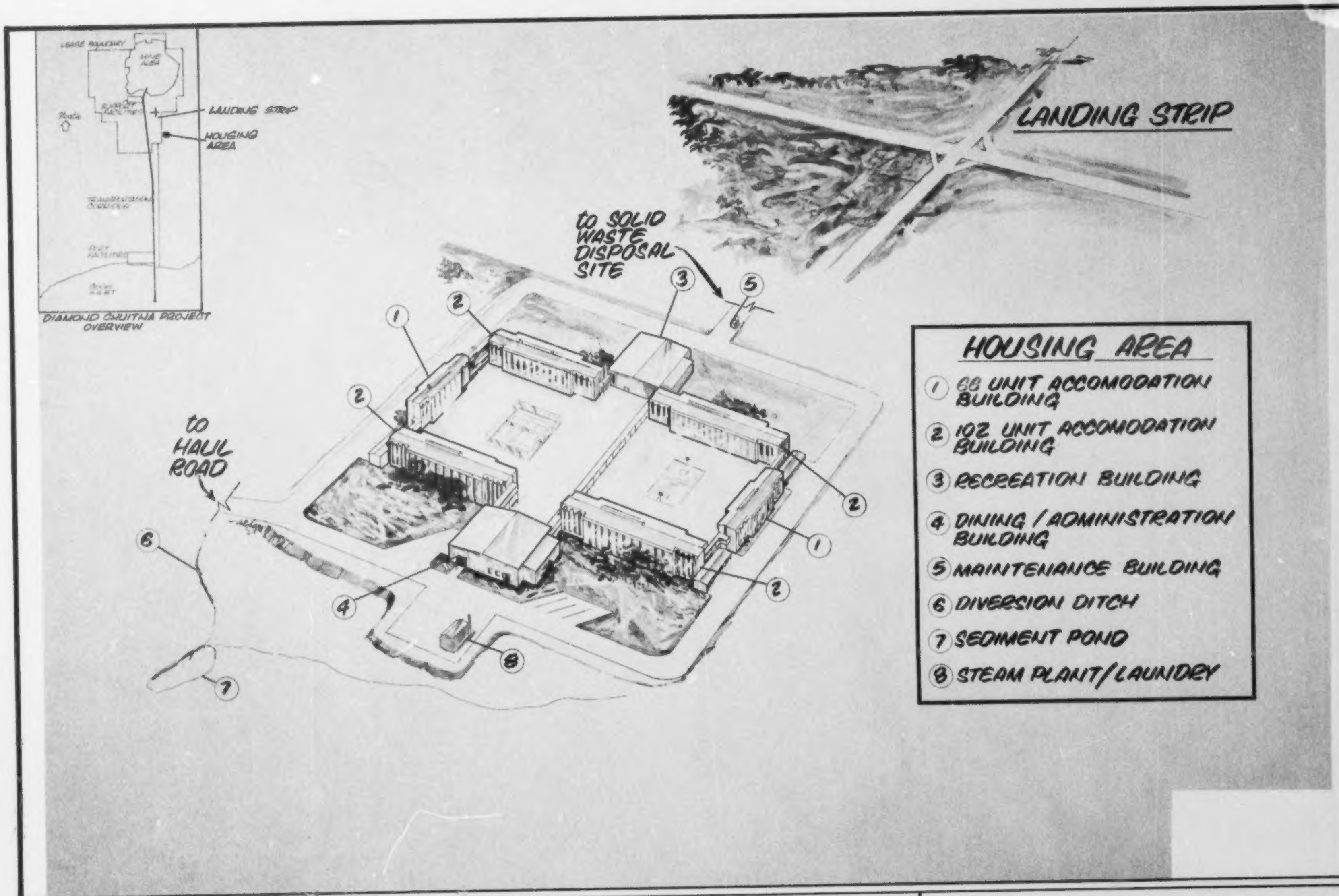
FIGURE 2-13

consist of four buildings with 102 units and two buildings with 66 units connected by all-weather corridors. Other facilities would include a dining hall/administration building, recreation center, laundry, medical facilities, security and fire services, and a maintenance building (Fig. 2-14). The facilities would be operated on the "motel" concept with employees checking into available rooms for their four-day stay at the project site. There would be no town at the housing site. The facilities would be designed for the actual number of employees on site (424) with a 27 percent contingency for weather conditions for a total of 540 beds. No employee-owned firearms or alcohol would be allowed at the housing facilities.

Water would be obtained from a series of ground-water wells with a storage capacity of approximately 302,800 l (80,000 gal) at the site. A packaged commercial sewage treatment plant with a capacity of approximately 189,270 l (50,000 gal) per day would handle sanitary and other drainage from the housing complex. Treatment would be at primary and secondary levels. Effluent from the Lone Creek housing area would be carried in a pipeline and discharged into the Chuitna River directly south of the housing site. Effluent discharge from the Threemile and Congahbuna housing sites has not been designed but would conform to state and federal regulations. The sludge effluent generated from treatment plants at any housing site would be hauled to the mine pit for burial.

Disposal of all wastes would be in approved sites. Nonorganic solid wastes would be deposited in fenced and enclosed dumpsters located throughout the housing area and collected on a regular basis. Initially, these wastes would be hauled to a temporary fenced landfill near the mine site which would be closed following completion of construction. For the first five to ten years of project operation, these wastes would be buried in a fenced landfill near the housing area. After that, the wastes would be hauled to the large permanent landfill in the vicinity of the mine. Solid wastes would not be put into the mine pit itself. Organic wastes would be deposited in separate fenced and enclosed dumpsters within the housing area and burned in a nearby incinerator. Hazardous wastes would be handled completely separately and would be removed from the project area entirely for disposal at an authorized hazardous waste site.

Drainage and sediment control would be handled by a ditch collecting system which would surround the facility and collect surface runoff and carry it to two sediment ponds for treatment and release to existing drainages. Treatment methods would be the same as for the mine service area and port site facilities, and water quality standards would be met before discharge.


LEASE BOUNDARY
MINE AREA
SUPPORT FACILITIES
North
LANDING STRIP
HOUSING AREA
TRANSPORTATION CORRIDOR
PORT FACILITIES
COOK INLET
DIAMOND CHUITNA PROJECT OVERVIEW
LANDING STRIP
to SOLID WASTE DISPOSAL SITE
to HAUL ROAD
1
2
3
4
5
6
7
8
HOUSING AREA
1 68 UNIT ACCOMODATION BUILDING
2 102 UNIT ACCOMODATION BUILDING
3 RECREATION BUILDING
4 DINING / ADMINISTRATION BUILDING
5 MAINTENANCE BUILDING
6 DIVERSION DITCH
7 SEDIMENT POND
8 STEAM PLANT/LAUNDRY

ARTIST'S ILLUSTRATION –
HOUSING AND AIRSTRIP FACILITIES

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FIGURE 2–14

2.6.2 Airstrip

A private gravel landing strip would be located close to the housing facility (Fig. 2-2). The main runway, 1,524 m (5,000 ft) long and 30 m (100 ft) wide, would be oriented in a north-south direction with a smaller 914 m (3,000 ft) east-west runway. The airstrip would have navigation lights, but would not be capable of handling instrument approaches in bad weather. A small terminal building and a maintenance building would be located at the site. Water requirements would be small and water would be hauled to the terminal building by truck. Chemical toilets would be used with sewage being hauled and dumped into the housing facilities' treatment plant. Gray water from the terminal would be treated to meet water quality standards and then released into the airstrip's drainage system which would discharge to existing drainages. There would be no sediment ponds. Solid wastes would be kept in an enclosed, fenced dumpster which would be regularly emptied and disposed of in the same manner as that for the housing area.

2.7 POWER GENERATION

Estimated average-load electrical power demands for the project at full operation would be approximately 35 Mw, with a maximum demand of 50 Mw. Power would be purchased from the existing Chugach Electric Association natural gas power station at Beluga (Fig. 2-1) and transported to the project site by a 69 kv line on wooden poles. If the Granite Point port site were selected, the powerline would follow the existing powerline right-of-way running from the power plant to the oil tank farm about 2.4 km (1.5 mi) west of the proposed Granite Point port site (Fig. 2-1). This existing right-of-way would not have to be widened and would connect with a wooden pole transmission line within the transportation corridor between the port site and the mine.

If the Ladd port site were selected, the powerline would follow the existing right-of-way until it intersected the transportation corridor where it would split to provide power to both the port site and the mine.

2.8 RECLAMATION PLAN

The discussion below summarizes the major aspects of the proposed reclamation plan. References are given to the location of more detailed information in the state surface mine permit application (Diamond Alaska Coal Company 1985).

2.8.1 Mine Pit

The reclamation plan for the mine area would have short-term as well as long-term goals. The short-term goal would be the immediate stabilization of the disturbed site through control of erosion and sedimentation. The long-term goals would be to: 1) establish wildlife habitat that would be at least as useful and productive as the premining environment; and 2) create an aesthetically acceptable site that blends with the surrounding terrain and vegetation. These goals would be met using the methods described below.

During the initial 10 years of operation, a total area of approximately 583 ha (1,440 ac) would be mined. Reclamation of disturbed sites would begin during the second year of mining (year five of the permit) and would follow, but not interrupt, mining annually until all acreage disturbed by mining and associated activities is reclaimed. No disturbed acreage would be unclaimed.

During the first year of reclamation, 1 ha (3 ac) would be reclaimed. During the next five years, 51 ha (125 ac), 56 ha (139 ac), 143 ha (354 ac), 61 ha (151 ac) and 75 ha (186 ac) would be reclaimed, respectively, for a total of 387 ha (958 ac) reclaimed after six years of mining. More detailed information may be found in Vol. XVI, Sec. 4.08, of the permit application.

2.8.1.1 Backfilling and Grading

After the initial box cuts have opened the pits for mining operations, the overburden and interburden material from the active mine areas would be backfilled by draglines and truck and shovel operations into the mined out areas (Fig. 2-3). Grading and stabilization then would be done by bulldozers and graders. The final topography would match the premining contours as closely as possible and would not exceed original slope grades. Slopes would be designed to minimize erosion and maintain adequate water retention for vegetative growth. Gradient terraces would be used to control sheet runoff.

Postmining surface drainage channels would be located to minimize erosion and slumping. Major reconstructed surface drainage channels would be lined with riprap* material as necessary to limit bank erosion and scour. The drainages would be reconstructed with gradients, meanders, and habitats similar to premining drainages to provide habitat for anadromous fish species.

No exposed coal seams would be left on the reclaimed surfaces. A minimum of 1.2 m (4 ft) of nontoxic and noncombustible spoil material would be used to cover any exposed seams that remained after mining. Any soil which does not meet the applicant's standards for revegetation also would be covered with a minimum of 1.2 m (4 ft) of nontoxic and noncombustible spoil material. No known acid-forming or toxin-forming spoil materials are present at the mine site and, therefore, no special handling techniques for these types of materials are anticipated.

2.8.1.2 Topsoil Handling Plan

Suitable topsoil material would be recovered from areas to be affected by mining and related operations prior to disturbance. The recovered topsoil would be either stockpiled for later use or redistributed directly on backfilled and graded areas. When possible, the topsoil would be immediately redistributed in preference to stockpiling. Topsoil removal, stockpiling, and replacement would be scheduled to coincide with the overall mining sequence.

Stockpiles would be designed to minimize wind and water erosion, and topsoil would not be disturbed or rehandled after stabilization unless the soil were to be redistributed on a graded surface. Unnecessary compaction and contamination of stockpiles would be eliminated and they would be protected from waste disposal, construction, and other such disturbances to maintain integrity. All stockpiles would be located within the mining limit and would be as small as possible.

Planting specifications to control stockpile erosion would differ depending on the life of the stockpile. Stockpiles remaining in place less than 30 days during the growing season would not be revegetated but would be left in roughened condition to retard erosion. Stockpiles remaining in place longer than 30 days during the growing season, but less than one calendar year, would be seeded with an annual seed mixture. Stockpiles to remain in place over one growing season and into or through additional growing seasons would be seeded with a permanent grass mixture and mulched.

Topsoil would be redistributed in a manner and at such time that: (1) achieves an average soil thickness of 15.2 cm (6 in) consistent with the revegetation goals, contours, and surface drainage systems; (2) minimizes compaction, contamination, and erosion; (3) conserves soil moisture and promotes revegetation; and (4) minimizes deterioration of the biological, chemical, and physical properties of the soil.

Following replacement and final grading of topsoil, but before seeding, a sampling plan would be implemented to evaluate the preparation of backfill and seedbed materials. This plan would include analysis of samples by a designated analytical laboratory.

Peat would be salvaged in advance of mining operations for recreating peat-filled wetland habitats on regraded soils. To the extent possible, stockpiling of peat would be avoided and no long-term (greater than 30 days) stockpiles would be established. Temporary peat stockpiles would remain isolated from topsoil stockpiles and would not be sited in drainage ways. More detailed information may be found on Vol. XVI, Sec. 4.10, of the permit application.

2.8.1.3 Revegetation

To determine which plant species would be used for revegetation, certain criteria were established:

- Native species would be used wherever possible.
- Seed mixtures and planting rates would reflect consideration of the relationship between herbaceous species and woody species in terms of competition for soil moisture, nutrients, and sunlight. For example, heavy seeding rates of vigorous, introduced grass species were considered inadvisable because of undesirable competition with wood species.
- Wildlife value would be a prime consideration in the selection of plant species and development of seeding and planting rates.

With the above goals in mind, preliminary seed mixtures and stocking selections were developed based on species characteristics, potential success, commercial availability, and availability of seed or cuttings stock on or near the permit area.

As soon as practicable after a disturbed area is returned to the proper contour and grade, topsoil would be spread and the site would be stabilized. Erosion and sedimentation would be minimized by construction of sediment control and retention structures, proper seedbed preparation, fertilization, and planting of rapidly establishing species. The longer-term goals of establishing productive wildlife habitat would be accomplished through additional planting of seedlings and cuttings of woody species.

Sediment ponds and associated diversion ditches would be removed at the completion of mining when the upstream drainage areas are stabilized, revegetation standards met, and acceptable water quality attained. Prior to regrading, ponds would be dewatered and the sediment material tested for toxicity. If unsuitable for use in the revegetation program, the material would be removed and buried under 1.2 m (4 ft) of nontoxic fill. Sediments should be stable in the landfill. No additional undue leaching should occur. Remaining ponds and associated drainage ditches would then be backfilled, graded, and revegetated. More detailed information may be found in Vol. XVI, Sec. 4.11 of the permit application.

2.8.2 Overburden Stockpile

The size, shape, and slope of the overburden stockpile would be such that stability would be assured once vegetation had been established. Though the topography of the stockpile would differ from the surface of the mined areas, slope angles would permit the use of agricultural equipment. Thus, the techniques described above for the mine area would also be used on the stockpile. Once a portion of the surface is no longer disturbed by stockpiling activities, revegetation would be completed during the next planting season using the same procedures described in Section 2.8.1.3.

2.8.3 Mine Service Area

All steel and fabricated buildings would be dismantled and removed for salvage. Structures and equipment of no salvage value would be buried in the mine pit. Other components, including concrete footings, slabs, and foundations would be removed at ground level before being buried in the pit. Gravel pad and road surfacing materials and all coal debris would also be disposed of in the mine pit. Sedimentation ponds and associated drainage ditches would be reclaimed as described for the mine pit area.

Once cleared, all excavations at the site would be filled and the site graded to the approved postmining topography. Areas exhibiting compaction detrimental to plant establishment would be ripped. Revegetation would be done in the same manner as described for the mine pit area.

2.8.4 Transportation Corridor

Any transportation facilities which could not be beneficially used for other purposes would be dismantled and salvaged. Any facilities not salvaged would be removed, foundation structures broken up, and the resulting rubble buried in an approved landfill. Disturbance to the land under the conveyor would be limited to a denuding of the ground surface where poles and conveyor braces had been located. These disturbed areas would be revegetated where more than 50 percent of the predisturbance vegetative cover is eliminated.

If the main haul road were not left intact for other users, road surfacing and culvert materials would be removed and buried in an approved landfill. The road bed would be ripped to relieve compaction and the roadbed and embankments would be graded to blend with adjacent undisturbed terrain. Temporary drainage features would be built to control runoff and erosion until revegetation of regraded areas occurs.

2.8.5 Port Site

Structures which would serve a useful purpose for continued activities would be left in place. The trestle might serve future coal mining or other mineral or natural resource development operations in the region. The facilities might also provide a source of revenue for other future businesses. In any event, all facilities which would not be retained for other beneficial uses would be appropriately reclaimed and the disturbed areas revegetated in the same manner as described above for the mine service area facilities. Instead of using the mine pit, any burial would take place in approved landfills.

2.8.6 Housing Area and Airstrip

All improvements would be dismantled and removed for salvage value. Foundations, roads, gravel pads, etc., would be appropriately reclaimed and the disturbed area revegetated as described above for the mine service area facilities. If the State did not want the airstrip to remain usable, it would be reclaimed and revegetated also.

2.9 FISH MITIGATION PLAN

The applicant has proposed several mitigation measures for the protection of fish resources during development and operation of the mine itself. These include construction and operational procedures, monitoring studies, and a restoration plan. Table 2-1 outlines the major proposed fish mitigation measures and associated monitoring programs. More detailed information may be found in Vol. XV, Sec. 4.07.1 of the permit application.

2.10 CONSTRUCTION

2.10.1 Schedule and Sequence

Once project construction is begun, it would take approximately three years to complete. Most construction would take place each year during the May through October period.

2.10.1.1 First Year

The first step would be establishment of a barge staging area at the base of the bluff below the port site (Fig. 2-12) and construction of a road up the bluff to the onshore port facilities site. The onshore port site would serve as the main construction camp and would have housing and dining facilities, construction offices, fuel tanks, sewage treatment plant, and temporary equipment service, repair and warehousing facilities. Vegetation clearing and grubbing would begin at the port site in preparation for the major civil work to be completed in the second year.

Because of its importance in development of the project, construction of the mine access/haul road would begin as soon as the initial facilities were established at the port site. Regardless of which port site were chosen, road construction equipment would be landed at the existing Ladd

TABLE 2-1

MAJOR PROPOSED FISH MITIGATION MEASURES AND MONITORING PROGRAMS DURING FIRST TEN YEARS OF PROJECT

IMPACT	MITIGATION	MONITORING
1) Increased sedimentation due to mining	A - Construct settling ponds designed to catch mine dewatering until sediment settles out.	NPDES permit compliance.
	B - Whenever possible, minimize use of construction and mining in streams other than those designated for mining.	Environmental coordinator would periodically check construction and mining areas for compliance.
	C - Prior to the construction of settling ponds, no mining in streams would occur during spawning periods of salmon species potentially using the mainstem section of watershed 2003.	Environmental coordinator would monitor construction activities to ensure compliance.
2) Habitat loss due to mining in streams	A - Rebuild sections of tributaries 200304 and 200305 to approximate premining conditions as much as possible.	Conduct fish habitat characterization studies once after restoration in order to determine value of streams in terms of potential fish use.
	B - Revegetate mined areas to minimize increased erosion rates and loss of overhanging vegetation in vicinity of streams.	Environmental coordinator would monitor revegetation efforts to determine program effectiveness.
3) Habitat loss due to altered flows in streams	A - Return water form sediment ponds into lower sections of tributary 200305 and 200304 and mainstem portions of watersheds 2003 and 2002.	Conduct an instream flow survey at stream location(s) exhibiting potential significant losses of salmon habitat. Survey would be conducted once after mined stream segments were restored.
4) Increased sedimentation and habitat alteration due to conveyor system and road crossing watershed 2003	A - Staging areas for stream crossings would be located outside of riparian zone to minimize amount of sediment entering stream and reduce disturbance to riparian vegetation and aquatic habitats.	Environmental coordinator would inspect stream crossing activity for compliance.
	B - A maximum ROW of 30 m (100 ft) would be used at the stream crossing to reduce disturbance.	Environmental coordinator would inspect design plans and construction activities.

TABLE 2-1
MAJOR PROPOSED FISH MITIGATION MEASURES AND MONITORING PROGRAMS DURING FIRST TEN YEARS OF PROJECT
(continued)

IMPACT	MITIGATION	MONITORING
	C - Construction methods would employ latest state-of-the-art techniques. (Examples of bank and stream bottom protection measures would include riprapping, upland storage of excavated riverbed materials, importing clean backfill, backfilling with previously excavated riverbed materials, and revegetation.	Environmental coordinator would review proposed construction methods and make suggestions on bank and stream bottom protection measures at each crossing. After construction, the coordinator would inspect condition of stream bank and bottom substrate and other fish habitat characteristics at an immediately downstream of the proposed crossing.
	D - Road crossing would be constructed and maintained to prevent obstructions to movements of adult and juvenile salmon.	Environmental coordinator would inspect construction activities and make observations during different flow regimes.
	E - Construction activities would be scheduled to avoid spawning periods of salmon if possible.	Environmental coordinator would review construction timing plans and inspect construction activities.
5) Alter water quality due to mine dewatering and relase of water from settling ponds.	A - NPDES permit compliance.	NPDES permit compliance.
6) Fuel or lubricant spills	A - Fueling and lubrication of equipment would not occur within approximately 201 m (660 ft) of streams. Equipment would be properly maintained and checked for leaks periodically. Spills would be reported immediately to the environmental coordinator.	Environmental coordinator would approve fueling locations and routinely check for compliance. Affected streams would be immediately surveyed for fish kills following a spill.

beach barge site and transported over the existing Ladd road to the mine area so road construction could be simultaneously carried out from both ends. Completion of the road would take about 18 months.

Clearing, grubbing, site grading, and electrical distribution networking would be completed at the housing facilities site, and the dining hall, recreation center and about one-fourth of the housing units would be constructed. The airstrip would also be constructed and made operational.

2.10.1.2 Second Year

The major civil and building construction work would be completed at the onshore port site. Pilings for the offshore elevated trestle would be driven and the conveyors at the onshore port site would be built. The mine access haul road would be completed and additional housing units, the boiler plant and communication facilities would be constructed at the housing area.

At the mine service area, most civil work would be done and the electrical system completed. Limited building construction would be initiated. Construction of the water control and treatment facilities for the whole mine area would also begin.

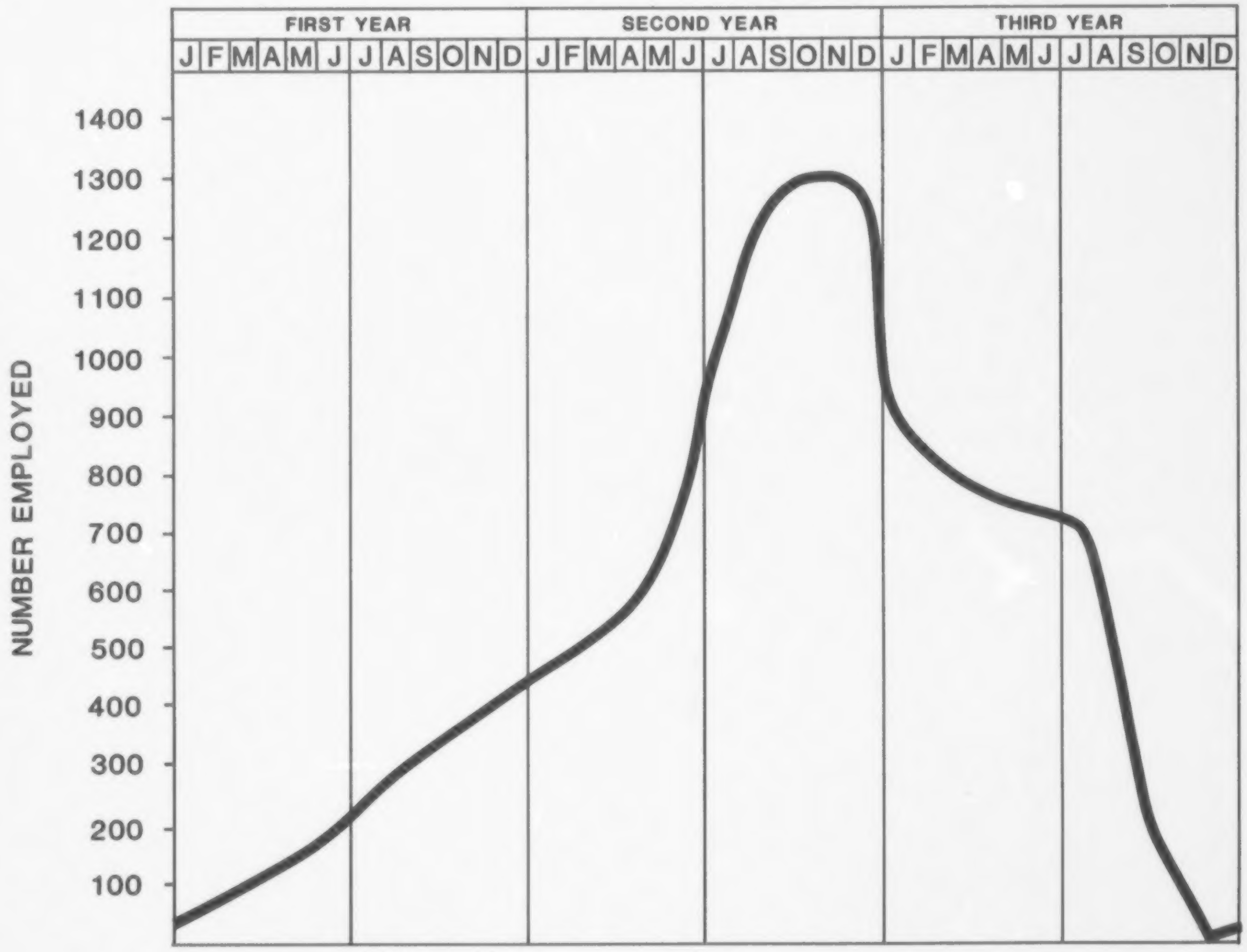
2.10.1.3 Third Year

The offshore trestle would be assembled on the pilings and the shiploader erected. The stacker-reclaimer would be erected at the onshore port site and the remainder of the housing units would be completed.

At the mine service area, facilities construction would be completed. Clearing and grubbing would begin at the mine site with initial stripping of overburden beginning late in the third year or early in the fourth.

2.10.2 Construction Employment

The estimated number of workers to be employed during construction is shown in Figure 2-15. Construction employment would gradually increase to approximately 430 at the end of the first year, then rise quickly to a peak of about 1,300 workers in October and November of the second year. Employment would then decrease quickly to approximately 750 between March and July of the third year. By the end of the third year, construction employment would drop to well below 100 when production would begin.



NUMBER OF WORKERS EMPLOYED, BY MONTH, DURING PROJECT CONSTRUCTION

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FIGURE 2-15

2.10.3 Construction Methods

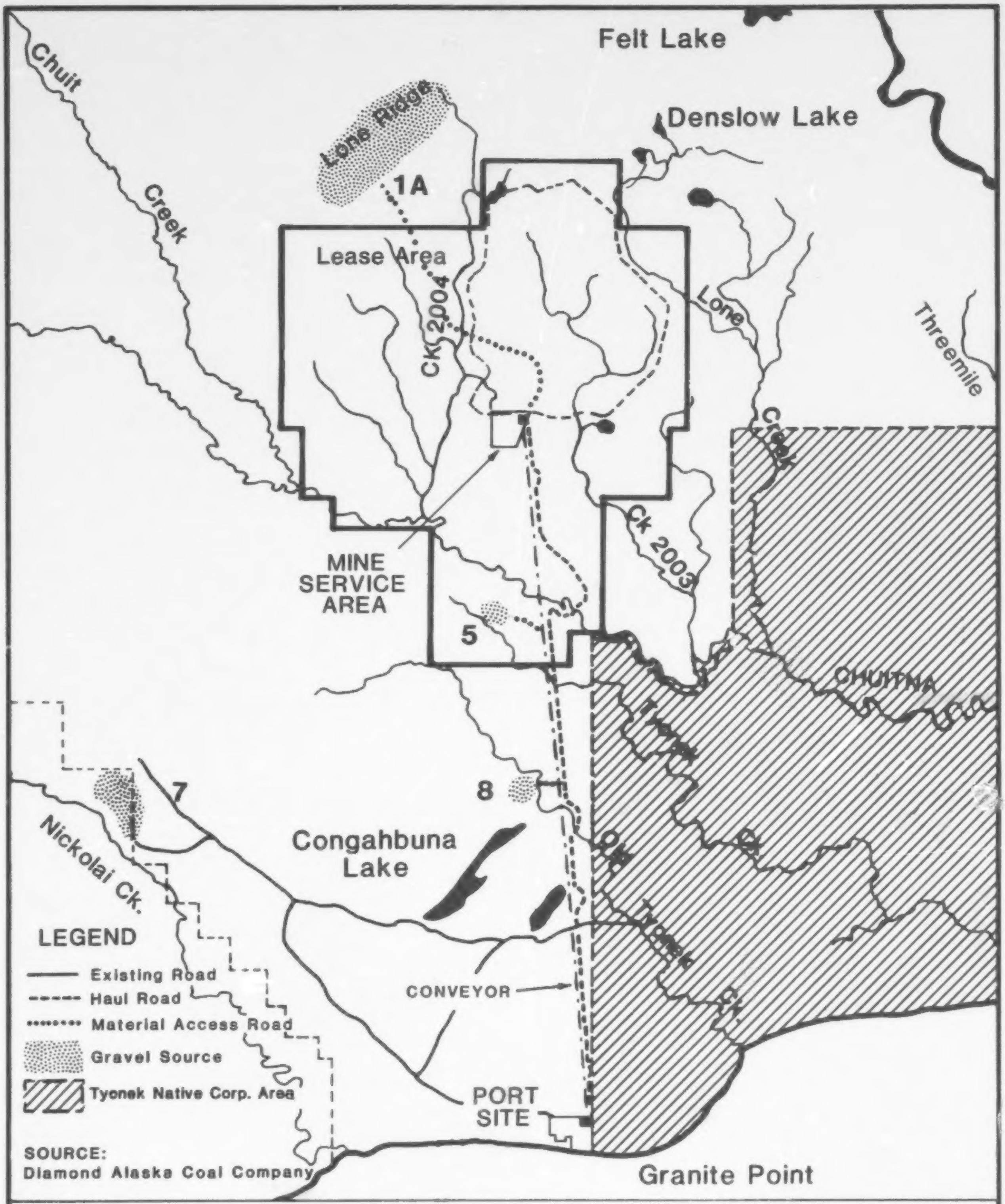
2.10.3.1 Facilities Sites

Construction methods for the three major facilities sites (the mine service area, onshore port site, and the housing area and airstrip) would be similar. Prior to actual construction, access roads to each facility would be installed. In general, fabrication of most facilities would be completed at factory locations with the modules being shipped by barge to the port for offloading, transportation to the site, assembling, and erection.

Site work would begin at each facility with clearing and grubbing of all trees and brush. This material would be put into windrows for burning, if conditions allowed, or buried under an adequate depth of spoil in the mine pit if burning were not possible. Areas with peat or muskeg deposits would be drained by ditches to facilitate removal. The peat would be hauled to a nearby disposal site which would be revegetated after it had served its purpose. Diversion ditches and sediment ponds would be constructed around the perimeter of the facilities to control and treat water runoff. Ditch sizes and sedimentation control methods would be similar to those described below for the haul road. After the facility sites were "final" graded, the modules would be trucked to the sites and actual construction of the buildings and other facilities would begin.

All subgrade and final grade gravel material, including that used for construction of the conveyor and haul road, would come from the areas shown in Figure 2-16, if the southern corridor is utilized. Probable gravel sites along the northern corridor are indicated in Figure 2-8. Gravel sites for use along the eastern corridor have not been investigated. Approximately 3.82 million m^3 (5 million yd^3) of borrow* material would be used for all project facilities. Of this total, approximately 458,760 m^3 (600,000 yd^3) would be gravel and 3,058 m^3 (4,000 yd) would be riprap or armor rock. The remainder would be any suitable fill material.

The material sources would be accessed by two-lane gravel roads suitable for heavy equipment. They would be located to maximize use of the existing logging and oil exploration road systems in the project area. Prior to any activity at the material sites, small diversion ditches, and berms would be constructed around the perimeter to divert surface runoff away from the area. Vegetation within the material pit boundaries would be cleared and disposed of in the same manner as described above for the facility sites. All surface material would then be removed and stockpiled in a suitable nearby location. Erosion control measures, including temporary seeding, would be used as appropriate to stabilize the stockpiles.


Felt Lake
Denslow Lake
Chuit Creek
Lone Ridge
1A
Lease Area
Ck 2004
Lone Creek
Threemile
MINE SERVICE AREA
Ck 2003
5
CHUITNA
7
8
Congahbuna Lake
Nickolai Ck.
LEGEND
Existing Road
Haul Road
Material Access Road
Gravel Source
Tyonek Native Corp. Area
CONVEYOR
PORT SITE
Granite Point

SOURCE:
Diamond Alaska Coal Company

GRAVEL SOURCE LOCATIONS, SOUTHERN CORRIDOR

Diamond Chuitna Environmental Impact Statement	FIGURE 2-16

In wet areas, sumps would be constructed at a low point on the pit bottom to collect water. Some small-scale blasting may be required to establish these drainage sumps. Small submersible pumps would be used to remove the water for discharge to the surface drainage system. Sediment fences, fabric filters, and straw bale dikes would be used as needed to remove sediment from the pumped water as well as to control sediment in and around the pit.

A tracked-dozer would be used to rip material and a front-end loader would feed it into a crusher hopper. The crushed material would be screened and stockpiled by size in the pit area prior to being hauled by scrapers or rear-dump trucks to use areas. During construction of the project facilities, the crushing and screening operation would be continuous. Following construction, the operation would occur on an intermittent basis.

When a material source is exhausted or when operation is impractical due to low demand or haulage distance, an area would be reclaimed to a condition compatible with, and similar to, the surrounding terrain. The pit would be backsloped either through placement of the stockpiled overburden material or through ripping and dozing to provide a stable slope to minimize erosion and blend with surrounding terrain. Suitable surface material would be replaced in a uniform thickness over the disturbed area and erosion control measures would be taken including contour furrowing, terracing, and construction of rock drains. The entire area would then be revegetated using a suitable seed mix of indigenous and introduced species.

No dredging or filling would be necessary for either the trestle or berthing offshore port facilities. Each monopile would be driven with hammers to a predetermined depth in the inlet floor for support of the approach trestle, shiploader and berthing dolphins. Structural steel trusses would then be placed on top of the monopiles with barge-mounted cranes to serve as the platform to support the conveyors and shiploading equipment.

2.10.3.2 Conveyor and Access/Haul Road

Conveyor construction would occur in two phases. In the first phase, clearing and grubbing work would remove all vegetation from the approximately 10.7 m (35 ft) right-of-way for windrowing and burning under permits from DNR and DEC. Then, only limited cut and fill operations would be necessary since generally both the conveyor and its adjacent service road would follow the natural terrain. The rigidity of the conveyor structure and the inherent design flexibility would allow localized topographic features such as small drainage channels to be effectively bridged. Upon completion of site preparation work, the conveyor support piers would be placed. In phase two, mobile cranes would lift prefabricated conveyor framework sections into place for attachment to the support piers.

Construction of the access/haul road would require some cut and fill operations which would occur simultaneously with placement of culverts. Where the road would cross a surface drainage channel, culverts designed to pass the peak discharge from a 10-year, 24-hour precipitation event, with no ponding on the upstream end, would be used. All culverts would be placed on suitable bedding material and appropriate riprap material would be incorporated at the inlet and outlet to minimize erosion. "Trash rack" structures would be installed at culvert inlets to prevent clogging due to debris.

In areas where adverse surface conditions exist for building roads (e.g., muskegs), a special construction technique would be used which would effectively "float" the road on the less competent underlying material. In this method, a flotation material, typically wood chips or logs, is placed directly on top of the undisturbed surface vegetative mat. A layer of minimally compacted fill material is then laid down followed by a geotechnical fabric which would provide lateral stability, distribute bearing loads over a large area, and allow drainage through the road base. Normal construction methods would then follow until the designed grade was achieved.

Permanent bridges would be of truss and girder construction supported by concrete piers (Fig. 2-11). Construction would be timed to minimize impacts upon spawning salmon or other fish movements and temporary pontoon bridges or stream fords would be used to provide equipment access.

During construction of the facility sites, conveyor and road, both temporary and permanent diversion ditches would be constructed to divert runoff from undisturbed areas either around the construction sites or through culverts installed under the road. These would be maintained until disturbed areas were effectively controlled. Additional drainage and sediment control measures would include surfacing of main roads and facility areas with gravel, and revegetation of road cuts, embankments and other disturbed areas as soon as possible after construction to minimize erosion. In sensitive areas, e.g., adjacent to stream channels, localized sediment control measures would be used, including rock filter dams, gradient terraces with filter ponds, rock drainageways, placement of sediment filter ponds and use of straw or vegetation sediment filters. All disturbed areas would be revegetated and mulched, if necessary, as soon as possible after completion of construction activities.

The access/haul road would be maintained on a regular basis. Maintenance would include grading, bridge, culvert and drainage ditch inspection, repair of any localized erosion on embankments, wetting of the road surface by water trucks to control dust during dry periods, and snow removal by snowblower to prevent buildup of high snow berms which would impede animal movements across the right-of-way.

2.11 OPERATION

2.11.1 Coal Production and Shipping Schedules

Under the optimal four-year full production development schedule, initial production would begin at a low level and build to full production. During the initial year of operation, approximately 1.8 million Mt (2 million short tons) of coal would be produced using two shifts of mine workers per day and truck/shovel operations in the pit. The coal would be transported to the port site on the access/haul road using truck tractors, each hauling two, 45.4 Mt (50 ton) uncovered trailers. The tractors would make approximately 55 round trips per day.

During the second year of operation, production would be increased to about 3.6 million Mt (4 million short tons) per year by adding a second work shift at the mine. The coal would still be hauled by trucks to the port site in approximately 99 round trips per day. Early in the second year, the first dragline would begin working. Later in the second year, the main overland conveyor would commence operation. This would eliminate the need to haul coal by truck to the port site. Production would increase in the third year to approximately 5.4 million Mt (6 million short tons) per year. In the fourth year, full production of 10.9 million Mt (12 million short tons) per year would be reached. In the fifth year, the second dragline would begin operation.

Shipping schedules and frequency would depend upon the size of the ships to be loaded. Table 2-2 shows approximate shipping characteristics for two sizes of ships at full production.

At lower production levels not requiring ships, barges would be berthed at the Ladd trestle for up to approximately 200 days per year.

Table 2-2

APPROXIMATE SHIPPING CHARACTERISTICS AT FULL PRODUCTION FOR TWO SIZES OF COAL SHIPS

Characteristics	100,000 dwt	60,000 dwt
Ship arrivals/yr	150	250
Interval between arrivals (days)	2.3	1.4
Berth loading time (hours)	25	15
Approximate berth occupancy	52%	57%

Source: Diamond Alaska Coal Company

2.11.2 Job Skills and Shift Schedules

An estimated total of 848 permanent employees would be employed by the project at full production, with half that total (424) being at the project site at any one time. There would be two 11-hour shifts each day. Thus, half the employees on site (212) would be working and half eating or sleeping at any given time. Employees would work a four-day-on, four-day-off schedule and would be flown back to their homes in Anchorage or on the Kenai Peninsula during their off-work periods. All operations except ship loading would be scheduled for 362 days per year (three-day holiday allowance). Shiploading would be scheduled for 350 days per year to allow 12 days for down time due to weather and ice conditions.

Table 2-3 shows the estimated buildup of new permanent project employees (excluding construction personnel) under the optimal, four-year full production development schedule.

Of these 848 employees, approximately 218 would be heavy equipment operators; 125 operators for trucks, light equipment and other machinery; 289 mechanics, shop hands, electricians, plumbers and other maintenance personnel; 110 miscellaneous personnel including cooks, bakers, housekeepers, dishwashers, and other life support functions; and 106 administrative personnel.

2.11.3 Fuel Handling

Because the project would receive, store, and use sizable quantities of diesel fuel, lubricating oils, and other liquids at various facilities, a Spill Prevention, Control and Countermeasure (SPCC) Plan would be prepared for each facility. Copies of that plan would be kept on file at each facility. Each plan would specify the methods which would be used to prevent and control spills which might occur during transportation, unloading, storage, or use of petroleum products. All personnel at each facility would be trained in spill prevention and appropriate personnel would be trained in the execution of the SPCC plan in case of a spill. Each facility would have adequate equipment available to complete cleanup operations. During construction each contractor would also be instructed in SPCC plan compliance and cleanup methods.

Table 2-3

NEW PERMANENT PROJECT EMPLOYEES
(EXCLUDING CONSTRUCTION PERSONNEL)
UNDER THE OPTIMAL, FOUR-YEAR FULL PRODUCTION
DEVELOPMENT SCHEDULE

	Project Year	New Employees
	1	--
	2	98
Construction	3	276
Mining Begins	4	140
	5	96
	6	86
	7	122
	8	30
Total		848

Source: Diamond Alaska Coal Company

Runoff water from the equipment washdown areas would contain oils, grease, solvents, and other hydrocarbon materials. The runoff pond receiving this water would be equipped with a skimming device to separate these materials and route them to storage areas.

Waste oil and other used hydrocarbon materials would be collected, stored, and removed from the project area for recycling or for disposal in approved waste disposal sites. Other hazardous waste materials (e.g., paint, solvents) would be handled and stored separately and shipped from the project area for disposal in approved waste disposal sites.

2.11.4 Air Quality Considerations

Burning of slash material from clearing and grubbing operations would occur only under favorable weather conditions and when permitted by DEC. Otherwise, slash would be buried under an adequate depth of spoil in the mine pit.

At all facilities, operations would be conducted to minimize coal dust, fugitive dust, and other emissions which might affect air quality. At the mine service area and the onshore port site, the coal stockpiles would be oriented to minimize contact with the prevailing north-south winds. Usually, no water would be sprayed onto the stockpiles because of the normal water content of the coal and because the coal would be regularly stacked and recovered and would not remain in the stockpile for long periods. If coal did remain in a stockpile for an extended length of time, periodic applications of water or water with a chemical dust retardant would be used. Tests on the spontaneous combustion potential of the coal indicated no susceptibility to firing while exposed to the atmosphere.

The coal stacking and recovery units would use water sprays to control dust during those operations. All conveyor systems would be designed to minimize wind effects. Both the mine conveyors and the main overland conveyor would be partially enclosed. The transfer points, including the second crusher in the mine service area, would use negative pressure systems, water sprays and/or other technology to capture as much coal dust as possible. Coal dust collected from the negative pressure systems would be put back onto the coal conveyors. The first crusher, in the mine area, would not have a negative pressure system since it would be open at the top to permit the trucks to dump coal into it.

Once the coal reached the shiploader, it would be discharged into the barge or ship holds through a fixed downspout. Coal would not be subjected to wind since the downspout would extend into the ship's hold, keeping most of the dust within the hold.

Fugitive dust would be minimized in several ways. Ground disturbance would be kept to a minimum with disturbed areas being revegetated as soon as possible. Exposed areas which would be continuously used, e.g., roads, pads, laydown areas, would be surfaced with aggregate material. When dry or windy conditions occur, these surfaces would be watered to keep dust down, and truck speeds would be reduced to lower fugitive dust emissions. During the early years of operations when coal would be hauled to the port site by trucks, road watering and use of a chemical dust suppressant, if required, would keep fugitive dust emissions to a minimum. Trucks would be properly loaded to prevent spillage when turning or braking. Spillage which did occur would be cleaned up to minimize coal fines on the road surface.

2.11.5 Environmental Training Program

An environmental training program designed to promote environmental awareness and highlight environmental protection and mitigation measures would be developed for contractors and employees. The program would include a description of existing environmental resources, identification of potential environmental impacts related to project operations, and a discussion of environmental protection and mitigation measures with emphasis on employee involvement.

2.11.6 Environmental Coordinator

An environmental coordinator would be located in Anchorage during the construction phase. Through onsite monitoring, the coordinator would assure adherence to project stipulations. During the operational phase, the coordinator would continue to ensure that environmental permit stipulations were met, direct the worker environmental training program, investigate human/wildlife contacts (including road collisions), oversee the various environmental mitigation and monitoring programs, and serve as agency contact for project status reports and site inspections. The environmental coordinator would be represented in the field by a full-time, on-site environmental supervisor with a support team made up of personnel from the revegetation and reclamation staff.

3.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 INTRODUCTION

Three types of alternatives exist for the Diamond Chuitna Coal Project: 1) alternatives that are available to the applicant (action alternatives); 2) alternatives that are available to the agencies which must act upon the applicant's various permit applications (agency alternatives); and 3) the No Action Alternative.

A description of the process of identifying and comparing the action alternatives and selecting the preferred alternatives constitutes the bulk of this chapter. The process is designed to avoid significant adverse project impacts. Identification of agency alternatives, which largely involves minimization of unavoidable adverse impacts is summarized in this chapter and detailed in Chapter 6.0. The No Action Alternative is discussed in this chapter.

3.2 ALTERNATIVES AVAILABLE TO THE APPLICANT

Identifying and comparing the alternatives available to the applicant (action alternatives) and selecting the preferred alternative is a process of systematically and rationally reducing a large number of options to a smaller number that ultimately represents the alternative with the fewest adverse impacts. It begins with the EIS scoping process which identified the range of options and then proceeds through screening and analysis stages as described below until the preferred alternative is identified.

3.2.1 Options Initially Considered

The EIS scoping process, described in Chapter 7.0, established important cornerstones for this EIS. First, it identified 10 issues of major concern to be addressed during the EIS process. These issues are described in Section 1.4 and were the bases for ultimately determining the action alternatives. Second, to address the 10 issues, the scoping process identified a full range of options for the project components (Table 3-1). The initial options considered the major technical, environmental, and economic issues associated with the project. These initial options are described below.

Thirty-one options were identified for the 12 project components (Table 3-1). One component, the mine, had only one option since the coal deposit, and therefore the mine location, was fixed. A second component, the mine service

Table 3-1

COMPONENT OPTIONS IDENTIFIED DURING THE SCOPING PROCESS

Component	Option
Mine Location	Fixed
Overburden Stockpile Location	North of mining limit Center Northeast Southeast
Mine Service Area Location	Fixed
Transportation System	
o Corridor/port Location	Northern/Ladd Eastern/Ladd Southeastern/North Foreland Southern/Granite Point
o Mode	Pneumo-train Coarse coal-water slurry Coal-carbon dioxide slurry Road Railroad Conveyor
Loading Facility	
o Type	Filled causeway Elevated trestle
o Length	Short Long
Housing	
o Location	Nikolai Congahbuna Lone Creek Threemile Creek
o Type	Townsite Single status
Airstrip	Existing New
Water Supply	Surface impoundments Wells
Power Supply	Purchase power from Chugach Electric Association

area (Fig. 3-1), was also relatively fixed because of its dependence upon the mine location and because it would be located at the approximate center of the three logical mining units within the lease area, thus allowing its use during future development of other coal resources. For a third component, power supply, the only option considered was purchase of power from the existing Chugach Electric Association power plant at nearby Beluga (Fig. 2-1). Since an existing powerline right-of-way from the Beluga Station would intersect each of the transportation corridor options, this option was clearly more environmentally favorable than any on-site generation option.

3.2.1.1 Overburden Stockpile Location

Four locations for the overburden stockpile were identified: north of the mining limit, in the center of the mining limit, northeast, and southeast (Fig. 3-1).

3.2.1.2 Transportation Corridor/Port Location

Four corridor options were identified (northern, eastern, southeastern, and southern) between the mine site and Cook Inlet (Fig. 3-2).

Northern/Ladd

This corridor would extend approximately 14.4 km (9 mi) east from the mine service area toward the Beluga airstrip, then turn south southeast for approximately 8 km (5 mi) to a port site at Ladd just north of the mouth of the Chuitna River, about 5.6 km (3.5 mi) north northeast of Tyonek.

Eastern/Ladd

This corridor would extend approximately 17.6 km (11 mi) east southeast from the mine service area to the same port site at Ladd.

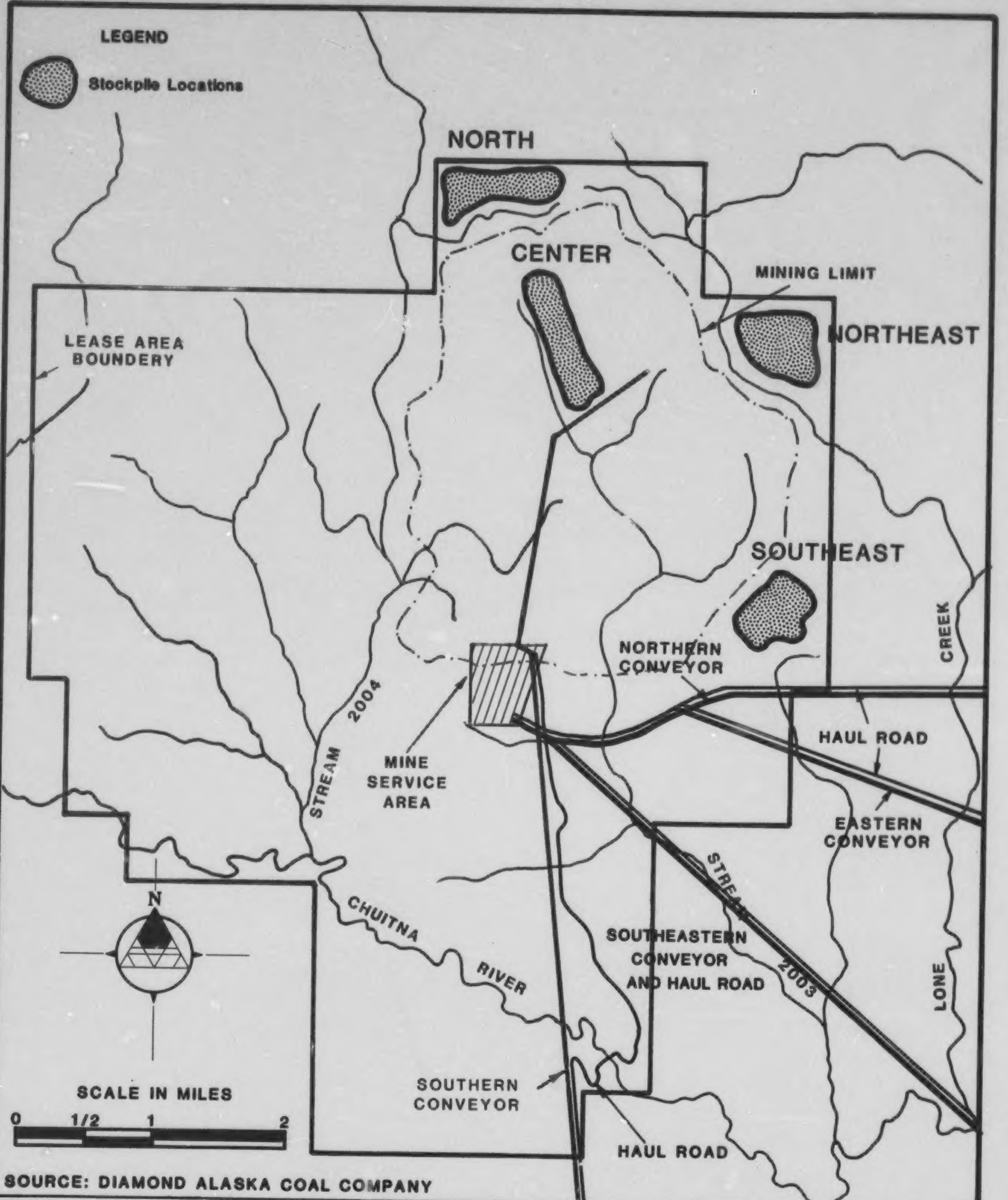
Southeastern/North Foreland

This corridor would extend approximately 18.4 km (11.5 mi) southeast from the mine service area to a port site at the North Foreland, about 2.4 km (1.5 mi) southwest of Tyonek.

Southern/Granite Point

This corridor would extend approximately 17.6 km (11 mi) south from the mine service area to a port site at Granite Point, about 14.4 km (9 mi) southwest of Tyonek.

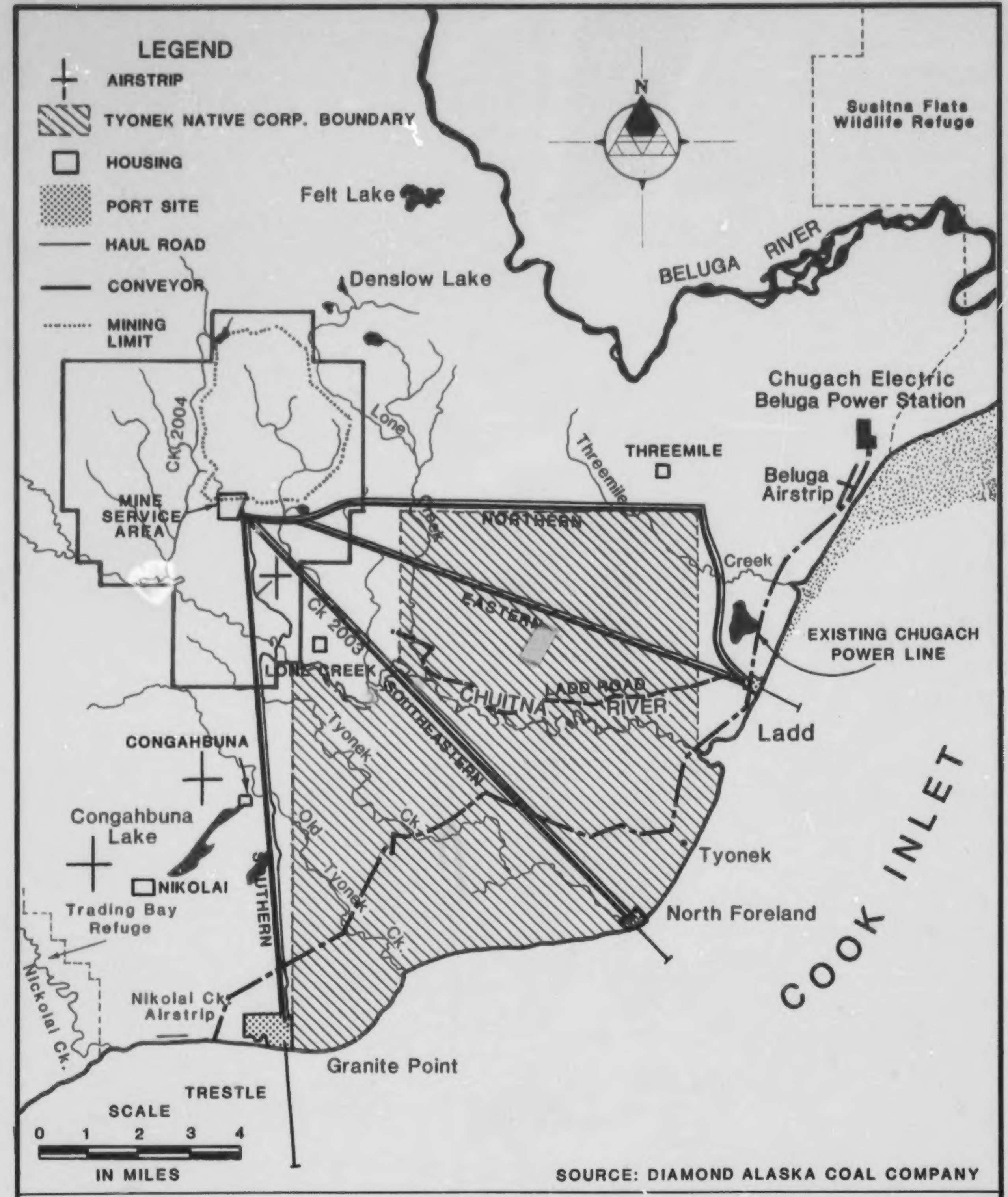
The existing Ladd Road (Fig. 3-2), primarily used in winter for moving heavy equipment in the region, was not considered since its alignment and condition are such that


LEGEND
Stockpile Locations
NORTH
CENTER
MINING LIMIT
NORTHEAST
LEASE AREA BOUNDERY
SOUTHEAST
CREEK
NORTHERN CONVEYOR
STREAM 2004
MINE SERVICE AREA
HAUL ROAD
EASTERN CONVEYOR
STREAM 2003
N
CHUITNA RIVER
SOUTHEASTERN CONVEYOR AND HAUL ROAD
LONE
SCALE IN MILES
0 1/2 1 2
SOUTHERN CONVEYOR
HAUL ROAD

SOURCE: DIAMOND ALASKA COAL COMPANY

INITIAL MINE AREA OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement | FIGURE 3-1


LEGEND
AIRSTRIP
TYONEK NATIVE CORP. BOUNDARY
HOUSING
PORT SITE
HAUL ROAD
CONVEYOR
MINING LIMIT
N
Felt Lake
Denslow Lake
Susitna Flats Wildlife Refuge
BELUGA RIVER
Chugach Electric Beluga Power Station
THREEMILE
Threemile
Beluga Airstrip
Ck 2004
Lone
Creek
MINE SERVICE AREA
NORTHERN
EASTERN
Ck 2003
LONE CREEK
SOUTHEASTERN
CHUITNA
LADD ROAD
RIVER
Creek
EXISTING CHUGACH POWER LINE
Ladd
CONGAHBUNA
Tyonek
Ck.
Congahbuna Lake
NIKOLAI
SOUTHERN
Old
Tyonek
Ck.
Tyonek
North Foreland
Trading Bay Refuge
COOK INLET
Nickolai Ck.
Nikolai Ck. Airstrip
Granite Point
TRESTLE
SCALE
0
1
2
3
4
IN MILES

SOURCE: DIAMOND ALASKA COAL COMPANY

INITIAL TRANSPORTATION CORRIDOR, HOUSING AND AIRSTRIP OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 3-2

it would have to be totally rebuilt with no significant environmental or economic savings.

3.2.1.3 Transportation Mode

Six options were identified for the method of transporting coal from the mine to the port site.

Pneumo-train

In this option, open-top, wheeled capsules would be loaded continuously with crushed coal at the mine and propelled down a buried pipeline by compressed air to the port. There the coal would be dumped and the cars returned to the mine via a second pipeline. The coal would be stored at the port for ship loading.

Coarse Coal-Water Slurry

The coal would be crushed, mixed with water, and pushed through a slurry pipeline to the port. There the coal would be separated from the water, dried, and loaded directly onto ships. The slurry pipeline would operate only when a ship was available for loading, thus eliminating the need for coal storage at the port. Slurry water would be processed and recycled back to the mine in a closed system.

Coal-Carbon Dioxide Slurry

In this option, coal would be washed, crushed to a fine powder, and dried at the mine site. The powdered coal would be mixed with liquid carbon dioxide (CO_2) and transported via pipeline to the port. At the port, the CO_2 would be heated and flashed, thus separating the coal for direct loading onto a waiting ship. No coal would be stockpiled at the port. The CO_2 would be recompressed and returned to the mine.

Road

For this option, the haul road initially built to supply the mine area, which would be used to transport coal to the port for the first years of production, would continue to serve as the transportation mode throughout the life of the project. At full production, approximately twenty-three truck tractors, each hauling two 45.4 Mt (50 ton) uncovered trailers, would make about 311 round trips per day between the mine and the port. Coal would be stockpiled until a ship arrived.

Railroad

Crushed coal would be loaded at the mine for transport by rail to the port. Approximately 3.3 round trips per day would be made using 100-car trains over 1.6 km (1 mi) in length. Coal would be unloaded from the heavy duty bottom-dump hopper cars and stockpiled until a ship arrived.

Conveyor

For this option, coal would be crushed, placed on a single span, covered, conventional belt conveyor, and carried to the port. Coal would be delivered directly to a ship or taken from the conveyor and stockpiled until a ship arrived.

3.2.1.4 Loading Facility Type

Two options for the coal loading facility were identified.

Filled Causeway

The causeway would be earth-filled and armored with rock. It would support the conveyor and shiploader structures as well as a road for operations and maintenance personnel. The causeway would be used for unloading barges and other fuel and supply ships.

Elevated Trestle

An elevated, pile-supported approach trestle would support the conveyor and shiploader as well as a narrow roadway for operations and maintenance personnel and equipment. While it would not serve supply barges (there would be a separate barge staging area on the beach), it would support a pipeline to move fuel from tankers or barges to storage tanks at the onshore port area.

3.2.1.5 Loading Facility Length

Both short and long loading facilities for full production were considered for each port location. The options represent the facility lengths necessary to reach water depths that would allow use by either smaller (60,000 dwt) or larger (up to 120,000 dwt) vessels. The smaller vessels would require a berthing depth of about 14 m (46 ft) at mean lower low water (MLLW) while the larger vessels would require between 15.2 to 18.3 m (50 to 60 ft) of depth.

3.2.1.6 Housing Location

Four options for the location of worker housing were identified (Fig. 2-1).

Nikolai Site

The Nikolai site is about 9.6 km (6 mi) northwest of Granite Point and 14.4 km (9 mi) south of the mine site. The housing area would be located on the edge of the Nikolai escarpment with a southerly exposure overlooking Trading Bay State Game Refuge.

Congahbuna Site

The Congahbuna site is immediately northeast of Congahbuna Lake, about 8 km (5 mi) north of Granite Point and 9.6 km (6 mi) south of the mine site. This site would be located in the middle of the southern transportation corridor option.

Lone Creek Site

The Lone Creek site is immediately north of the Chuitna River about 12.8 km (8 mi) north of Granite Point. It would be west of Lone Creek and about 4.8 km (3 mi) southeast of the mine site.

Threemile Site

The Threemile site is north of Threemile Creek and south of the Beluga River about 6.4 km (4 mi) west of the Chugach Electric Association Beluga Power Plant. This site is located just north of the northern corridor.

3.2.1.7 Housing Type

Two options for worker housing were identified.

Townsite

The townsite would have a large proportion of individual houses and apartments for workers and their families. Additional community facilities would include schools, hospital, recreation center, religious facilities, town administration offices, police and fire stations, supermarket, and department store. The townsite would function as a largely self-contained entity with workers commuting to work daily from their homes as do most workers in Alaska. No transportation to the townsite from Anchorage would be provided and workers would live and recreate in and around the townsite.

Single Status Housing

Single status housing facilities would provide individual rooms for workers in a camp-type housing complex which would include a dining hall/administration building, recreation center, laundry, medical facilities, and security and fire services. Minimal emphasis would be placed on shopping and commercial facilities since the personal needs of the workers, including routine health care, would be served during their off-work, off-site periods. Workers would be flown to the project area from Anchorage and Kenai for their time on the job and then be returned home for their off-work periods.

3.2.1.8 Airstrip

Two options for location of an airstrip were identified: an existing airstrip in the region or a new one in proximity to the housing area.

3.2.1.9 Water Supply

Two options were considered for supplying both the industrial and domestic water needs of the project: surface impoundments and wells.

3.2.2 Options Screening Process

The options screening process was conducted in two steps. First, all 31 options identified during the scoping process were initially evaluated to eliminate those options which were clearly unreasonable or infeasible for environmental, technical, or other reasons. In the second step, all remaining options not eliminated in step one were evaluated in greater detail.

3.2.2.1 Initial Options Evaluation

Each of the 31 component options identified during the scoping process was individually reviewed from environmental and technical perspectives. If an option was environmentally and technically reasonable and feasible, it was retained for further analysis. If, however, the option was determined to be unreasonable or infeasible, and if other options retained for that component adequately addressed the 10 scoping issues, it was eliminated. Table 3-2 identifies the nine options eliminated during this initial options review, and outlines the major reasons why each was eliminated. Table 3-3 summarizes the results of the initial options evaluation process and shows which options were retained or eliminated.

The elimination of the southeastern/North Foreland transportation corridor/port location option requires some amplification. The North Foreland port site is located on land owned by TNC and was considered as an option because there is an existing port at the site, including a pier, which was used in the 1970s for loading wood chips aboard vessels for transport to market. An analysis of the pier, as well as tidal currents and ice conditions, was conducted by the applicant (Soros Associates 1986) to determine the feasibility of using the North Foreland site. That study, as reviewed by Dames & Moore, showed low ship berthing availability due to tidal currents and ice for any pier located at that site. While berthing availability would probably be adequate to load coal during the lower coal production levels early in the project, serious difficulties and vessel delay could be expected during full coal production levels of 10.9 million Mt (12 million short tons).

Table 3-2

MAJOR REASONS FOR ELIMINATION OF INDIVIDUAL OPTIONS DURING INITIAL OPTIONS EVALUATION

Component	Option Eliminated	Major Reasons for Elimination
Overburden Stockpile	Center	o Inside mining limit (stockpiled material would have to be rehandled to mine under stockpile)
	Northeast	o Would require a bridge across Lone Creek o Visual impacts
Transportation Corridor/Port Location	Southeastern/ North Foreland	o Port site tidal currents and ice conditions prevent ship berthing/loading to full project production capacity
Transporation Mode	Pneumo-train	o Demonstration plant technology only
	Coarse coal-water slurry	o Moderate product degradation (10% BTU loss from water) o Unproven Arctic technology o Spill hazard
	Coal-carbon dioxide slurry	o Pilot plant technology only o Spill hazard o Final product not presently marketable
Loading Facility	Filled causeway	o Large quantities of fill and armor rock required o Constant protection from tidal and ice scour required o Interference with anadromous fish movements and local set net fishery
Housing Type	Townsite	o Substantially greater infrastructure required (water, sewer, housing, etc.) o Adverse to local autonomy o Less adaptable to traditional regional lifestyles o Competition with subsistence activities o Greater land area impact o Greater impacts on fish and wildlife (increased hunting & fishing; human/wildlife contacts; etc.)
Water Supply	Surface impoundments	o Block free-flowing streams o Interference with fish movements o High dams to store water in winter

Table 3-3

OPTIONS ELIMINATED OR RETAINED FOR FURTHER ANALYSIS DURING INITIAL OPTIONS EVALUATION

Component	Options Retained	Options Eliminated
Mine Location	Fixed[1]	
Overburden Stockpile Location	North Southeast	Center Northeast
Mine Service Area	Fixed[1]	
Transporation System		
o Corridor/Port Location	Northern/Ladd Eastern/Ladd Southern/Granite Point	Southeastern/North Foreland
o Mode	Road Railroad Conveyor	Pneumo-Train Coarse Coal-Water Slurry Coal-Carbon Dioxide Slurry
Loading Facility		
o Type	Elevated Trestle[1]	Filled Causeway
o Length	Short Long	
Housing		
o Location	Nikolai Congahbuna Lone Creek Threemile Creek	
o Type	Single Status[1]	Townsite
Airstrip	Existing New	
Water Supply	Wells[1]	Surface Impoundments
Power Generation	Purchase[1]	

---

[1] Sole option remaining for this component

The existing pier was also judged inadequate since water depth is not sufficient to accommodate vessels of 72,576 Mt (60,000 dwt) or larger needed at full production. Further, it is misaligned with respect to dominant ebb and flood current direction, it has an inadequate fender system and sedimentation at the berth, and it is structurally inadequate to support a movable type shiploader needed to load ships at full coal production levels.

As a result of the initial options screening, the number of components with only one option to be considered increased to six. Housing type, water supply, and type of loading facility joined the mine location, mine service area location, and power supply as single option components.

3.2.2.2 Remaining Options Evaluation

Since all options in the applicant's Proposed Projects were environmentally and technically reasonable and feasible, each of those options was retained so that the applicant's Proposed Projects would constitute formal alternatives to be analyzed during the analysis of alternatives process. Then, for each component where at least one option other than the applicant's choice remained, all options were individually evaluated from the perspective of each resource or technical discipline (e.g., water quality, subsistence, technical feasibility, etc.). If it was determined that one of the other options was as good as, or better than, the applicant's option on an overall basis, or if it addressed one or more of the 10 scoping issues in a significantly more favorable manner than did the applicant's proposed option, that option was retained for the analysis of alternatives process.

The following discussions summarize the results of these more detailed analyses and describe why an additional seven options and one component were eliminated from consideration. Generally, only those disciplines which would likely have a reasonable difference in impacts between options are discussed.

Overburden Stockpile

The two remaining stockpile locations, north and southeast (Fig. 3-1), would have similar impacts on water quality and vegetation, but the north site would be closer to fish spawning habitat and would be in the southern portion of a fall moose rutting* area. Also, use of the north site would subject drainage 2004 to project-related disturbance immediately rather than 22 years into the project. The north site would have poorer foundation conditions and would cause greater negative visual impacts than the southeast. On the basis of this analysis, and since it did not address any of the 10 scoping issues more favorably than the southeast site (the applicant's proposed option), the north site was eliminated, leaving the southeast site as the single option for location of the overburden stockpile.

Transportation Corridor/Port Location

Initial analysis of the three options showed that all were environmentally and technically reasonable and feasible. Because of the complicated nature of a discipline-by-discipline comparison among all three options, and since the northern/Ladd option and the eastern/Ladd option shared the same port site, it was logical to do a comparative analysis between these two options to determine if one option could be eliminated.

To compare these options, a specific set of "options screening criteria" was developed to evaluate potential impacts (Table 3-4). Table 3-5 summarizes the comparative resource discipline analyses for the northern/Ladd and the eastern/Ladd transportation corridor/port site options based upon the options screening criteria in Table 3-4. For each of the 10 disciplines, the potential adverse impacts for each option are shown relative to those for the other option. Generally, only those screening criteria having a reasonable difference in adverse impacts between options are discussed.

Analysis of relative potential for adverse impact to water quality showed that since the eastern/Ladd option would be shorter and make fewer stream crossings, it was considered to have a relatively low potential for adverse impact from sediment production during construction, operation, and reclamation. The northern/Ladd option was judged to have a relatively moderate potential for adverse impact.

From a vegetation standpoint, the longer northern/Ladd option would directly affect a larger acreage of vegetation and 44 percent more wetlands. Indirectly, the northern/Ladd option would potentially impact a greater area of vegetation due to traffic-generated dust. Therefore, the northern/Ladd option was judged to have a relatively moderate potential for impact while the eastern/Ladd option was judged to have a relatively low potential.

Analysis of the relative potential impact to fish showed that the eastern/Ladd option would involve four stream crossings with two crossings being in areas of high fish value. The northern/Ladd option would involve five to eight stream crossings with at least two crossings being in areas of high fish value. Thus, the overall relative potential for adverse impact for the eastern/Ladd option was judged to be low, while that for the northern/Ladd option was judged to be moderate.

From a wildlife perspective, the northern/Ladd option would directly impact more wetlands and riparian habitats

Table 3-4

TRANSPORTATION CORRIDOR/PORT LOCATION INDIVIDUAL DISCIPLINE OPTIONS SCREENING CRITERIA

Discipline[1]	Options Screening Criteria
Water Quality	Sediment production from road surfaces, cuts, fills, sideslopes and stream crossings Reclamation difficulty Spill Hazard (includes offshore port)
Vegetation	Direct vegetation loss Indirect loss from dust and vehicle or foot traffic Relative value of wetlands lost
Fish	Presence or absence of fish Value in terms of spawning, rearing or migration Number of stream crossings
Wildlife	Direct habitat loss Indirect habitat loss due to noise, other disturbance or human contacts Effects on animal movements
Socioeconomics	Local resident control of, or input to, project through land ownership Proximity of port site to Tyonek Income from corridor and port site leases
Subsistence	Interference with access to traditional use areas Interference with existing harvest activities Changes in resource availability (increased competition, reduced populations, changes in movement patterns)
Recreation	Impacts on existing recreation
Regional Use	Flexibility for other regional uses Size and location of component sites adequate for expansion Preclusion of other users or uses Consolidation with existing facilities
Technical Feasibility	Availability of adequate construction technology Relative complexity of design, construction and operation
Reclamation	Reclamation difficulty

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[1] Includes only disciplines having a reasonable difference in impacts among the options

Table 3-5

COMPARATIVE RESOURCE DISCIPLINE ANALYSIS OF RELATIVE POTENTIAL ADVERSE IMPACTS FOR THE NORTHERN/LADD AND EASTERN/LADD TRANSPORATION CORRIDOR/PORT SITE LOCATION OPTIONS

	Northern/Ladd			Eastern/Ladd		
Discipline[1]	Low	Moderate	High	Low	Moderate	High
Water Quality		M		L		
Vegetation		M		L		
Fish		M		L		
Wildlife			H		M	
Socioeconomics		M		L		
Subsistence	L			L		
Recreation		M		L		
Regional Use		M			M	
Technical Feasibility	L			L		
Reclamation		M		L		

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[1] Includes only disciplines having a reasonable difference in adverse impacts between the options.

important to waterfowl and bears, respectively. Indirect habitat loss for swan nesting and rearing would be equally high for both options, but the northern/Ladd option would pass within 457 m (500 yd) of an eagle nest. Effects upon animal movements for both options would be similarly moderate. Therefore, the northern/Ladd option was judged to have a relatively high potential for adverse impacts upon wildlife while the eastern/Ladd option was considered to have a relatively moderate potential.

Analysis of the socioeconomic impacts upon residents of Tyonek showed that the eastern/Ladd option would cross lands owned by TNC, thereby giving Tyonek residents some degree of control over project design and location as well as direct income from a corridor right-of-way lease. The northern/Ladd option would not cross any TNC lands. Both options would offer the same benefits of proximity to jobs as well as the disadvantages of the port site being relatively close to the village. Thus, the eastern/Ladd option was judged to have a relatively low potential for adverse impact while the northern/Ladd option was judged to have a moderate potential.

From a subsistence perspective, the potential for adverse impact to residents of Tyonek from either the eastern/Ladd option or the northern/Ladd option was considered to be low since Tyonek residents make relatively little use of lands affected by those options. The level of impact to the small number of residents between the Ladd port site and the Beluga power station is unknown, but would likely not differ significantly between the two options.

Analysis of relative potential impact to recreation showed that the northern/Ladd option crossed more streams than did the eastern/Ladd option, including three or four crossings of Threemile Creek. The northern/Ladd option would also pass very close to Viapan and Tukallah Lakes. Thus, the northern/Ladd option was judged to have a relatively moderate potential for adverse impact while the eastern/Ladd option was judged to have a relatively low potential.

From a regional use perspective, there was no significant difference between the options relating to size or ability to expand to accommodate other users, nor was there a difference in consolidation with existing facilities. Both options would cross private land which might restrict other potential uses in the future. The northern/Ladd option would cross the southern extreme of another state coal lease (Fig. 4-1), thus making development more economically feasible by having a road and conveyor right on the lease. This was not judged, however, to be a significant difference considering the relatively small advantage this would provide to the lease holder. Thus, on an overall regional use basis, both options were considered to have moderate potential for adverse impact.

Analysis of technical feasibility showed adequate construction technology exists for both options, with neither having significant complexity of design, construction, or operation. Thus, both options were judged to have a relatively low potential for adverse impacts.

From a reclamation perspective, the northern/Ladd option, with its greater length and acreage of wetlands and higher number of stream crossings, was considered to be more difficult to reclaim. Thus, the eastern/Ladd option was judged to have a relatively low potential for adverse impacts while the northern/Ladd option was judged to have a moderate potential.

Overall analysis of the 10 resource disciplines for the two transportation corridor/port site options showed (Table 3-5) that the eastern/Ladd option clearly had a lower overall potential for adverse impacts than did the northern/Ladd option. The eastern/Ladd option was judged to have a low potential for adverse impacts for eight of the 10 disciplines with none rated as having a high potential, while the northern/Ladd option was judged to have a low potential for impacts for only two disciplines and rated as having a high potential for one.

In final analysis, the eastern/Ladd option was judged superior to the northern/Ladd option. However, despite its inferior rating, the northern/Ladd option could not be eliminated at this early option screening stage because it is one of the applicant's alternatives. Therefore, both options were retained and specifically addressed in the comparison of action alternatives process.

Transportation Mode

Table 3-6 summarizes the resource discipline analysis of the three remaining transportation modes for moving coal from the mine to the port: road, railroad, and conveyor (the applicant's proposed option).

For each discipline, the potential adverse impacts for each option are shown relative to the potential impacts for the other two options. For the road option, it is important to keep in mind that a road from the port to the mine would still exist in any event, i.e., the road would be there whether or not another coal transportation mode was constructed. Therefore, cumulative adverse impacts were considered for construction of the other transportation modes. For example, the road would have a lower adverse impact than the railroad or conveyor on vegetation because their construction would destroy additional vegetation, while use of the existing road to haul the coal would

Table 3-6

RESOURCE DISCIPLINE ANALYSES OF THE RELATIVE POTENTIAL ADVERSE IMPACTS OF TRANSPORTATION MODE OPTIONS

	Mode								
	Road			Railroad			Conveyor		
Discipline[1]	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Water Quality			H	L			L		
Air Quality			H		M		L		
Vegetation	L					H			H
Fish		M		L			L		
Wildlife			H		M		L		
Subsistence		M				H			H
Visual			H		M			M	
Noise			H		M		L		
Recreation			H		M		L		
Economics		M				H	L		
Reclamation	L					H		M	
Regional Use		M		L				M	

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[1] Includes only disciplines having a reasonable difference in adverse impacts among the options.

cause no additional vegetation destruction (assuming adequate dust control measures). The following discussion addresses only resource discipline analyses which showed a reasonable difference in adverse impacts among the options.

Because of the high level of truck traffic necessary to transport the coal by road at full production (approximately 331 round trips per day), erosion problems, hence potential adverse water quality impacts, would be significantly greater than for either the railroad or conveyor options, both of which were rated as relatively low.

By the same reasoning, the road option rated high for potential adverse air quality impacts. The railroad, which would generate a diesel smoke plume and some dust, was rated as moderate. The conveyor option was rated as low.

From a vegetation perspective, the road option rated relatively low since the road would already exist and only moderate additional vegetation destruction would occur if it continued to be used to haul coal throughout the life of the project. Potential adverse railroad impacts were rated as relatively high due to the necessity to clear and maintain another right-of-way. Although the conveyor itself would sit on elevated supports, it would need an adjacent service road throughout its length which would also require clearing and maintenance of another right-of-way. The conveyor option was also rated as having a relatively high potential for adverse impacts to vegetation.

The greater potential adverse water quality impacts identified for the road option, discussed above, resulted in a relatively moderate rating for potential adverse fish impacts while the railroad and conveyor options were rated as relatively low for this discipline.

From a wildlife perspective, the road option possesses a relatively high level of potential for adverse impacts because of disturbance from noise and vehicle movements associated with the 331 round trips per day (an average of one truck with two trailers passing a given point every 2 minutes, 22 hours per day, 362 days per year). Also, deep snow in winter would cause moose to use the cleared road to move about, resulting in more frequent vehicle/moose collisions. The railroad option would generate substantially less noise and movement on a continuous basis than would the road, but it would have the same problems with moose collisions in winter. It was rated as having a relatively moderate potential for adverse impact. The conveyor would be stationary and would generate significantly less noise. Its main potential adverse impact would be physical blockage of animal movements, a problem not associated with either the road or railroad. Since large animal crossings would be designed into the conveyor option, it was rated as having a relatively low potential for adverse impact.

The road and railroad would potentially have direct adverse impacts upon subsistence resources. The moose population, especially, would be expected to be adversely affected as a result of collisions with vehicles. The railroad and conveyor could also have direct impacts upon subsistence use because they could physically block access across the transportation corridor. With the conveyor generally elevated only 0.6 m (2 ft) above the ground (with no clearance in winter due to snow), traditional winter travel across the corridor could be limited to the road and large animal crossings. The railroad right-of-way could pose a similar though less formidable obstacle, especially to snow machines. Thus, the road was considered to have a relatively moderate potential for adverse impacts on subsistence while the railroad and the conveyor were considered to have relatively high potential for adverse impacts.

Visually, the road, with its frequent truck traffic and associated dust, was judged to have a relatively high level of potential for adverse impact. The railroad, with its 5.5 m (18 ft) high engines and 1.6 km (1 mi) long trains was judged to have a relatively moderate level of potential for adverse impact. The conveyor would be stationary and stand about 2.7 m (9 ft) above the ground and was also judged to have a relatively moderate level of potential for adverse impacts.

The road option was determined to have a relatively high potential for adverse impacts from noise associated with truck traffic. The railroad was judged to have a moderate relative potential impact for noise, while the conveyor was determined to have a relatively low potential impact.

From a recreation perspective, noise and visual considerations (including dust) were the primary factors used to determine effects upon the quality of the recreation experience. On that basis, the road was determined to have a relatively high potential for adverse impact while the railroad was judged to have a relatively moderate potential. The conveyor, with its stationary nature and lower noise level, was judged to have a relatively low level of potential impact.

On the basis of initial capital as well as operation and maintenance costs, the road option was judged to be of moderate overall economic impact while the railroad was determined as having a relatively high economic impact. The conveyor was judged to have an overall relatively low economic impact.

From a reclamation perspective, the road, which would exist in any event, was considered to have a relatively low potential for adverse impacts. The railroad was judged to have a relatively high potential impact because of the necessity to reclaim the greater cuts and fills necessary to maintain grade and to remove the large bridge across the Chuitna River if the southern corridor option were selected. The conveyor, which would largely be elevated above the ground on pilings, was considered to have a relatively moderate potential for adverse impacts from reclamation.

The railroad seemed to possess some possible advantage over the other two options when considering future regional uses. The road option would exist for other potential users regardless of which other coal transportation mode was built. The conveyor system would be sized for the output of the Diamond Chuitna project only. If another coal development commenced operations during the life of the Diamond Chuitna project or if another large development occurred after the coal mine was terminated, the conveyor system would not have the capacity or geographic flexibility to handle additional coal. The railroad option could provide some advantage for another coal development project favorably located with respect to the right-of-way. However, another project of similar size to the Diamond Chuitna project would probably have to substantially upgrade the size of any existing railroad system to meet its needs. Thus, both the road and the conveyor options were judged to have a relatively high potential for adverse impacts from a regional perspective (i.e., both would have no significant positive effect on promoting a regional coal transportation system), while the railroad was judged to have a relatively moderate level of adverse impacts.

Overall analysis of the three options (Table 3-6) clearly showed that the conveyor option had the lowest levels of relative adverse impacts for the twelve disciplines considered. The conveyor option showed relatively high potential for adverse impacts for only three disciplines: vegetation, subsistence and regional perspective. The relative differences among the three options for potential impacts to vegetation were not judged to be significant. The relatively high adverse impact rating for the regional use discipline was also judged not to be significant because it merely means that the conveyor would not have a positive effect on promoting a regional coal transportation system, but it would not in any way preclude such a system from being developed in the future.

The one major discipline concern for the conveyor was the relatively high potential impact of blocking access to traditional subsistence use areas if the southern corridor/Granite Point option were selected. This concern could be addressed by providing enough crossings to permit subsistence users reasonable access to traditional use areas. It was felt that this potential problem could be adequately handled in the design of that option, and thus the conveyor system (the applicant's proposed option) was judged the best overall transportation mode option for addressing the 10 scoping issues.

Loading Facility Length

Both full production options identified, i.e., a short trestle and a long trestle, were dependent upon vessel draft and water depth. The greatest difference between these options would occur at the Granite Point port site where the shorter trestle would be approximately 2,277 m (7,470 ft) and the longer trestle 3,810 m (12,500 ft). Analysis showed only three areas where a reasonable difference between the options would exist. Visually, the longer facility would have a greater adverse impact. It would also require somewhat greater travel time for a larger boat moving along the coast to pass around it. Smaller boats, which make up the majority of existing use, could sail through the 122 m (400 ft) openings between the trestle supports. From a regional use perspective, however, the longer facility could be considered more favorable because of its increased flexibility for other potential users. None of these three differences was considered significant and neither option addressed any of the 10 scoping issues in a significantly more favorable manner than the other. Thus, it was judged that length of the loading facility was not of significant importance and it was dropped as a component.

Housing Location

Initial analysis of the four housing location options, Nikolai, Congahbuna, Lone Creek (the applicant's proposed option), and Threemile, showed that three of the four sites were corridor specific (Fig. 3-2). Lone Creek was the only option which could be used regardless of which transportation corridor was selected. Both the Nikolai and Congahbuna sites are located well south of the mine area near Granite Point and would be practical only if the southern corridor were selected. The Threemile site is just north of the northern corridor near the Beluga power station and would be practical only if the northern corridor were selected. Since all four sites had already been determined to be environmentally and technically reasonable and feasible, it was decided to retain each corridor-specific option for alternative analysis with its respective corridor. This was predicated on the assumption that the option was the best one for that corridor and that it addressed at least one scoping issue more favorably than did the Lone Creek site. The Lone Creek site would be retained in any event because it is the applicant's proposed option and it is not corridor specific.

Analysis of the Nikolai and Congahbuna options showed that they are within 4.8 km (3 mi) of each other and have many similarities. Because the two sites are so similar, it appeared most logical to compare them to one another to select the more favorable for retention.

Although the Nikolai and Congahbuna sites showed few significant differences among potential adverse resource discipline impacts, the Nikolai site was considered to have more potential for adverse impacts upon both fish and wildlife because it is closer to Nikolai Creek and Trading Bay Refuge. Also, Nikolai would have a greater adverse visual impact because it would be located apart from the conveyor and the haul road whereas Congahbuna would be in the transportation corridor immediately adjacent to the conveyor and haul road. The Nikolai site, being further from the mine site, would also increase the daily cost of transporting the majority of workers to their work stations. From the subsistence perspective, however, there does not appear to be much use of the Nikolai site by local residents while the area in the vicinity of Congahbuna Lake receives some use for hunting, picnicking, and berry picking. Taking all potential impacts into account, the Congahbuna site collectively was judged to be more favorable than the Nikolai site.

A further analysis between the Lone Creek and Congahbuna housing site options showed that the Congahbuna option addressed at least two scoping issues (fish and socioeconomics) in a significantly more favorable manner than did the Lone Creek option. Therefore, the Congahbuna option was retained for alternatives analysis.

Analysis of the Threemile housing site showed this option addressed at least one scoping issue (regional use) in a more favorable manner than did the Lone Creek option. Therefore, the Threemile option was retained for the alternative analysis process.

Airstrip Location

Two options were identified for locating the airstrip to be used to shuttle workers between the project area and their homes in Anchorage and on the Kenai Peninsula: use of a presently existing airstrip in the vicinity of the project area or construction of a new airstrip adjacent to the housing site ultimately selected. The latter is the applicant's preferred option.

Using an existing airstrip would offer the advantages of lower capital costs for construction and less environmental impact at the site of the proposed new airstrip. Disadvantages would include: the possible need to construct additional roads and bridges to access an existing strip; greater operational costs and environmental impacts from transporting workers and equipment significantly greater distances; the necessity to substantially upgrade an existing airstrip; and the possibility of more marginal operating conditions because the existing runway alignment might not be optimum. Other disadvantages related to the operation of an existing airstrip at greater distances from the housing site would include the need to construct larger terminal facilities to shelter workers waiting for planes, the increased risk and liability from unauthorized use of a previously public airstrip by private pilots, hunters or fishermen, and vandalism.

On a more site-specific basis, all currently usable airstrips in the vicinity of the project area which might be upgraded to handle traffic needs for the Diamond Chuitna Project are private. Thus, their availability for use by the project would be uncertain. The major airstrips (Beluga, Tyonek, and Nikolai Creek) would be located approximately 19.2 to 28.8 km (12 to 18 mi) from the mine site. While the Beluga airstrip is presently capable of handling the traffic needs of the project, Tyonek and Nikolai Creek are not. They both would require lengthening and construction of a cross runway. This would probably not be possible at Nikolai Creek because of space limitations and the substantial adverse wetlands impacts which would occur. Whether residents of Tyonek would consent to a major upgrading and operation of a busier airstrip immediately adjacent to the village is doubtful.

Other airstrips in the vicinity are mostly smaller ones built to support short term oil and gas drilling operations. Some are presently useable by small aircraft, but all would require substantial upgrading and construction of a cross runway before being capable of supporting the project's operational needs. From a strictly geographical standpoint, the "Pan Am" airstrip, located only 0.6 km (0.4 mi) east of the Lone Creek housing site, would appear to be the most logical location because it would be close to the mine site. However, its location on the bluff above stream 2003 would prevent it from being upgraded to sufficient size.

On the basis of the advantages and disadvantages discussed above, it was judged that use of an existing airstrip in the vicinity of the project area, as opposed to construction of a new airstrip immediately adjacent to the housing site, would not address any of the 10 issues in a significantly more favorable manner. This option was therefore eliminated.

At the completion of the options screening process, a total of one component and 15 options had been eliminated. The options that were retained and used to form the action alternatives are shown in Table 3-7.

3.2.3 Identification and Description of Action Alternatives

The options screening process left only two components with more than one option remaining: the transportation corridor/port site location and the housing site location. Since the applicant wishes to retain two transportation corridor/port site options (southern/Granite Point and northern/Ladd), two alternatives using these options were identified as the applicant's proposed projects. A third

Table 3-7

OPTIONS USED TO FORM ALTERNATIVES

Component	Option(s)
Mine Location	Fixed
Overburden Stockpile Location	Southeast
Mine Service Area	Fixed
Transportation System	
o Corridor Location	Southern/Granite Point Northern/Ladd Eastern/Ladd
o Mode	Conveyor
Loading Facility	Elevated Trestle
Housing	
o Location	Lone Creek Congahbuna Threemile Creek
o Type	Single Status
Airstrip	New
Water Supply	Wells
Power Generation	Purchase

alternative, using the eastern/Ladd option, is also discussed. Finally, two housing/airstrip options other than the applicant's proposed option at Lone Creek were identified. The following sections describe the action alternatives that have been selected for detailed consideration in this EIS. Table 3-8 presents a matrix showing which components are included in each alternative.

3.2.3.1 Southern/Granite Point Alternative

In addition to the fixed mine and mine service area locations, this alternative would site the overburden stockpile southeast of the mining limit. It includes a conveyor system within the southern transportation corridor to the site at Granite Point (Figs. 2-1 and 3-1). The port coal-loading facility would be an elevated trestle. A single-status housing facility with associated new airstrip would be located at the Lone Creek site. Water would be supplied by wells and power would be purchased from the Chugach Electric Association natural gas power station at Beluga.

3.2.3.2 Northern/Ladd Alternative

This alternative is the same as the southern/Granite Point alternative except the northern transportation corridor to a port site at Ladd would be used (Fig. 2-1).

3.2.3.3 Eastern/Ladd Alternative

This alternative would be the same as the northern/Ladd alternative except that the eastern corridor to a port site at Ladd would be used (Fig. 2-1).

3.2.3.4 Housing/Airstrip Options

Congahbuna Housing/Airstrip Option

This option would be substituted for the Lone Creek housing/airstrip site in the southern/Granite Point alternative with the housing area and the airstrip being located at the Congahbuna site (Fig. 2-1).

Threemile Housing/Airstrip Option

This option would be substituted for the Lone Creek housing/airstrip site in the northern/Ladd alternative with the housing area and the airstrip being located at the Threemile site (Fig. 2-1).

3.2.4 Comparison of Action Alternatives

The three action alternatives were compared to determine the preferred alternative. The Congahbuna and Threemile housing/airstrip options were then compared with the Lone Creek option to determine whether either option

Table 3-8

DIAMOND CHUITNA PROJECT ACTION ALTERNATIVES

Project Components and Options	Action Alternatives		
	Southern/ Granite Pt.	Northern/ Ladd	Eastern/ Ladd
Mine Location* - Fixed	X	X	X
Overburden Stockpile Location* - Southeast	X	X	X
Mine Service Area* - South of Mining Limit	X	X	X
Transportation			
a) Corridor/Portsite			
1. Southern/Granite Point	X		
2. Northern/Ladd		X	
3. Eastern/Ladd			X
b) Mode* - Conveyor	X	X	X
Loading Facility* - Trestle	X	X	X
Worker Housing			
a) Location			
1. Lone Creek	X	X	X
2. Congahbuna			
3. Threemile			
b) Type* - Single Status	X	X	X
Airstrip* - New Construction	X	X	X
Water Supply* - Wells	X	X	X
Power Generation* - Purchase Gas	X	X	X

*Components with only one option.

provided a significant advantage over the Lone Creek site such that it could substitute for the Lone Creek option in one or more of the alternatives. The analytical basis for the comparisons in this section is provided in the detailed impact discussions in Chapter 5.0. The reader is encouraged to consult Chapter 5.0 for more extensive examination of the major issues.

Evaluation criteria based on the ten issues identified during scoping (Section 1.4) were developed to compare the three action alternatives and the housing options. The criteria are shown in the first column of Table 3-9. For each scenario, the evaluation criteria were applied separately to each alternative to determine the relative values for the total potential impacts for that alternative. It is important to note that the "relative total impact value" assigned to a given alternative for a specific criterion was derived only by evaluation of that alternative relative to the other alternatives for that scenario. The relative values used were low, moderate, and high.

For example, using the third evaluation criterion (Table 3-9), i.e., "Minimize impacts to wildlife and wildlife habitats," each alternative was analyzed from the standpoint of its total potential for impacts to wildlife and wildlife habitat and a relative value (compared to the other two alternatives) was assigned. Only significant differences in potential impacts were considered. Thus the southern/Granite Point alternative had a relatively moderate value for total potential wildlife and wildlife habitat impacts compared to the northern/Ladd and eastern/Ladd alternatives which had relative values of high and low, respectively. Table 3-9 summarizes the relative total impact values for each evaluation criterion. This allows a consistent comparison of alternatives to be made.

It must be emphasized that while a particular alternative might be assigned a high relative total impact value when compared with the other alternatives, it does not necessarily mean that the alternative would have a high absolute impact. In this chapter, therefore, alternatives were assigned a total impact value relative to one another while the actual significance of the alternatives' impacts are described in Chapter 5.0.

Analysis showed that, because of the specific nature of the project and the make-up of the action alternatives, most of the significant potential impacts were associated directly with activities at the mine and that there were relatively few significant differences in potential impacts among the other project components. Since all impacts associated directly with the mine and its attendant operations were common to all alternatives, the comparison of alternatives process addresses only potential impacts associated with the components of the project other than the mine. The locations of the transportation

Table 3-9

EVALUATION CRITERIA MATRIX SHOWING RELATIVE TOTAL IMPACT VALUES ASSIGNED TO THE THREE ACTION ALTERNATIVES

	Evaluation Criteria	Southern/ Granite Pt.	Northern/ Ladd	Eastern/ Ladd
1.	Minimize risk of water quality degradation and alteration to flows	Moderate	Moderate	Low
2.	Minimize impacts to fish and fish habitat	Moderate	Moderate	Low
3.	Minimize impacts to wildlife and wildlife habitats	Moderate	High	Low
4.	Minimize potential reclamation problems	Low	Low	Low
5.	Minimize impacts to set net fishery	Moderate	High	High
6.	Minimize impacts to traditional subsistence harvest activities	High	Low	Low
7.	Minimize social, cultural, and economic impact upon local residents	Moderate	Moderate	Low
8.	Minimize cumulative regional use impacts	Low	Moderate	Moderate
9.	Minimize technical complexity	Low	Low	Low
10.	Minimize cost	No Data	No Data	No Data

corridor, port site, and the housing and airstrip sites were the only components creating significant differences in potential impacts among alternatives.

Water Quality

Potential water quality impacts were evaluated primarily on the basis of the risk of petroleum product spills and sediment production from road surfaces, pads, cuts, fills, and stream crossings. No significant differences in potential impacts were identified between the southern/Granite Point and northern/Ladd alternatives. The eastern/Ladd alternative would have fewer potential impacts since it would be shorter and cross no major streams as would the southern/Granite Point alternative. It would also cross flatter terrain than either of the others. Therefore, the southern/Granite Point and northern/Ladd alternatives were assigned moderate relative total impacts values for water quality while the eastern/Ladd alternative was assigned a low value.

Fish

Potential impacts to fish and fish habitat were evaluated primarily on the basis of the presence or absence of fish, the number of stream crossings, and the value of potentially affected streams for fish spawning, rearing or migration.

No significant differences in potential impacts were identified between the southern/Granite Point and northern/Ladd alternatives. The eastern/Ladd alternative would have fewer potential impacts since it would cross fewer streams than the northern/Ladd alternative and would cross no major streams as would the southern/Granite Point alternative. It would also impact fewer lakes than either of the other alternatives. Therefore, the southern/Granite Point and northern/Ladd alternatives were assigned moderate relative total impact values for fish while the eastern/Ladd alternative was assigned a lower value.

Wildlife

Potential impacts upon wildlife were evaluated primarily on the basis of direct and indirect habitat loss since potential impacts arising from interference with movements across the corridors could be largely mitigated by proper design, construction, and operation of animal crossings.

The northern/Ladd alternative was considered to have greater potential impacts than either of the others because it is longer and would cross riparian habitat important to brown bears feeding upon salmon. The southern/Granite Point and northern/Ladd alternatives would have similar impacts to wetlands important to wildlife, but the eastern/Ladd alternative would cross fewer important wetlands than either of them. The eastern/Ladd alternative, unlike the other two alternatives, would also avoid eagle nests. Thus, the eastern/Ladd alternative was assigned a low relative total impact value while the southern/Granite Point and northern/Ladd alternatives were assigned values of moderate and high, respectively.

Reclamation

Essentially all of the major reclamation concerns identified during the scoping process were focused on the mine and its surrounding area. Technology for successful reclamation of the other project components exists and has been demonstrated to be effective for other Alaska projects. Since reclamation procedures that would be used at the mine and its surrounding area would be common to all three alternatives, no significant differences were identified among the three alternatives for this criterion and all were assigned a low relative total impact value.

Set Net Fishery

Potential adverse impacts to the commercial set net fisheries near the port sites were evaluated primarily on the basis of interference with fish movements and existing set net sites caused by the supply barge unloading facility, the approach threstle, and coal vessel traffic.

The Ladd port site and supply barge unloading facility were judged to have a significantly greater potential for impact upon set net sites since they are located in the midst of one of the most productive set netting areas in upper Cook Inlet. The Granite Point site would also impact some set net sites, but to a lesser extent. Both the northern/Ladd and eastern/Ladd alternatives were thus assigned a high relative total impact value while the southern/Granite Point alternative was assigned a moderate value.

Subsistence

Potential subsistence impacts were evaluated primarily on the basis of: 1) effects on access to, and use of, traditional use areas; 2) changes in fish and wildlife abundance; 3) interference with fish and wildlife cycles or movements; 4) increased nonresident harvest of subsistence resources; and 5) the possibility of increasingly restrictive harvest regulations.

The southern/Granite Point alternative was judged to have a significantly greater potential for impacts to subsistence since the lower corridor and port site would be in areas traditionally used for subsistence by residents of

Tyonek while the other two alternatives are located in areas with no significant subsistence use. Also, the southern/Granite Point alternative would open access to the Chuitna River to impacts on subsistence fish species. Therefore, the southern/Granite Point alternative was judged to have a high relative total impact while the northern/Ladd and eastern/Ladd alternatives were judged to have low values.

Socioeconomics

No significant differences in socioeconomic impacts to Anchorage or the Kenai Peninsula were identified among the three alternatives. Potential socioeconomic impacts to Tyonek were evaluated primarily on the basis of effects upon: 1) local employment, 2) community population and infrastructure, and 3) social and cultural values.

No significant differences were identified among the three alternatives for local employment since Tyonek is connected to the southern/Granite Point alternative by the existing road system and a small vehicle bridge would be built across the lower Chuitna River to provide access to either of the two other alternatives. The social and cultural impacts to residents of Tyonek would be similar for any of the three alternatives. If the eastern/Ladd alternative were selected, however, it could give Tyonek a significantly greater degree of control over the project and would increase the applicant's accountability to the community. Tyonek would also receive revenue from the transportation corridor right-of-way lease. Therefore, the eastern/Ladd alternative was assigned a low relative total impact value while the southern/Granite Point and northern/Ladd alternatives were assigned moderate values.

Regional Use

Potential impacts to regional use were evaluated primarily on the basis of consolidation with existing facilities, potential for other regional uses, and component size, location, and adequacy for expansion.

The southern/Granite Point alternative would be closer than the other two alternatives to areas most likely to be developed in the future (e.g., the Placer U.S. Center Ridge coal deposit west of the Diamond Chuitna project area). This could have a positive effect upon the feasibility of some potential developments since a crossing of the Chuitna River would not be required to reach the port site as would be necessary with either the northern/Ladd or eastern/Ladd alternative.

The southern/Granite Point alternative would also consolidate with the existing road system and facilities in the Granite Point area while the other alternatives would not consolidate with existing facilities to the same extent. This, however, was not judged to be significant.

The southern/Granite Point alternative would be constructed entirely on public land and the port site would have ample room for expansion, thus likely making the corridor and port site available to other potential users. The northern and eastern corridors, however, would cross some private lands which may not be available to future users. Also, while the port site at Ladd is public land, the amount of public land is not as large as at Granite Point, possibly precluding expansion to accommodate other users and requiring development of another port.

In the final analysis, the southern/Granite Point alternative was judged to have a low relative total impact value while the northern/Ladd and eastern/Ladd alternatives were judged to have moderate values.

Technical Complexity

Potential technical complexity impacts were evaluated primarily on the basis of the availability of adequate technology and the relative complexity of design, construction, and operation. Adequate technology presently exists to design, construct, and operate all three alternatives. Both port sites have shoals offshore which would need to be considered in navigating ships during operations. This was not considered a significant cause for concern in either situation. Therefore, all three alternatives were assigned a low relative total impact value.

Cost

No comparative cost data for any of the three alternatives were made available by the applicant. Therefore, no relative total impact values have been assigned for this criterion.

3.2.5 Identification of Preferred Alternative

The comparison of alternatives process described above assigned relative total impact values to the three action alternatives for each of the ten evaluation criteria (Table 3-9). It should be remembered that when using relative total impact values, the lower the value the better, i.e., a lower value equates with a lower potential for adverse impact. Inspection of Table 3-9 shows that for the nine evaluation criteria for which data were available, seven showed significant differences among the three alternatives: water quality, fish, wildlife, set net fishery, subsistence, socioeconomics, and regional use.

The eastern/Ladd alternative clearly had the lowest overall relative total impact value. For five of the seven criteria showing a significant difference among the alternatives, it received a low rating. Only for the set net fishery criterion did it receive a high rating.

While impacts to set netters from a port site at Ladd could be significant, proper scheduling and operational management at the port site would likely substantially reduce or eliminate significant impacts to the fishery. Such impacts probably would not occur from coal loading operations at full production which would take place at the end of the trestle over 3 km (1.8 mi) from shore, but rather from the supply barge staging area on the beach adjacent to the trestle. Since the set net sites are used only during the fishing season, and then only on certain days of the week, proper scheduling of incoming supply barges to avoid fishing openings and to accommodate local fishermen's traditional uses could likely avoid serious impacts.

On the basis of its having the least overall relative total impact value and the capability of substantially reducing or eliminating significant impacts to the lone criterion (set net fishery) for which it received a high rating, the eastern/Ladd alternative was identified as the preferred alternative.

Whether the applicant could develop an eastern corridor, however, is not certain. The corridor would cross private land owned by TNC and to date, the applicant and TNC have been unable to negotiate a right-of-way agreement. Since there is no assurance that an eastern corridor could be developed even though identified as the preferred alternative, the southern/Granite Point and northern/Ladd alternatives were further analyzed to determine the secondary preferred alternative.

The southern/Granite Point and northern/Ladd alternatives showed significant differences in potential impacts for four criteria: wildlife, set net fishery, subsistence, and regional use (Table 3-9). The potential exists for significantly greater impacts to the set net fishery for the northern/Ladd alternative as discussed above for the eastern/Ladd alternative. Proper scheduling and operational management, however, would substantially reduce or eliminate such impacts.

The differences for the wildlife criterion were considered significant. The northern/Ladd alternative would have greater adverse quantitative and qualitative habitat impacts that could not be mitigated to eliminate those differences.

For the subsistence criterion, the southern/Granite Point alternative would have significantly greater adverse impacts that could not be mitigated to eliminate the differences. The northern/Ladd alternative would have very limited impact on subsistence values while the southern/Granite Point alternative would be built through a significant traditional use area.

From the regional use perspective, the low potential for adverse impacts for the southern/Granite Point alternative was considered a significant benefit. The size of the area available for the port site at Granite Point as well as its geographic location with respect to likely future developments and the southern corridor's location entirely on public land were considered to be significantly better than for the northern/Ladd alternative.

Thus the lower potential for adverse impacts from the southern/Granite Point alternative for the set net fishery, wildlife and regional use criteria were countered by the higher potential for impacts for the subsistence criterion. Therefore, on an overall basis the southern/Granite Point alternative was judged to have a lower potential for adverse impacts than did the northern/Ladd alternative. Although the preponderance of higher potential for adverse impacts to the evaluation criteria from this comparison were attributed to the northern/Ladd alternative, the potential effects upon local residents from the higher impacts to subsistence from the southern/Granite Point alternative were not lightly dismissed. Thus, while the overall potential for adverse impacts was judged higher for the northern/Ladd alternative, it was not a clear cut difference.

3.2.6 Comparison of Housing/Airstrip Options

The three alternatives compared above all used the Lone Creek site as the option for the housing and airstrip components. Two other options were identified for those components and are compared below to the Lone Creek site. These are the Congahbuna and Threemile sites. The purpose of this comparison was to determine whether either site provided a significant advantage over the Lone Creek site such that it could be substituted for the Lone Creek option in one or more of the alternatives.

The differences in impacts to the evaluation criteria among all three housing/airstrip sites are described below. For each criterion, the basis for the evaluations were the same as those used above in comparing the three alternatives (e.g., spill risk and sediment production for water quality, direct and indirect habitat loss for wildlife, etc.). The relative total impact values assigned to a criterion for each housing/airstrip option are shown in Table 3-10.

Water Quality

No significant differences in potential water quality impacts were identified for any of the three options. Therefore, each was assigned a low relative total impact value.

Table 3-10

EVALUATION CRITERIA MATRIX SHOWING RELATIVE TOTAL IMPACT VALUES ASSIGNED TO THE THREE HOUSING OPTIONS

Evaluation Criteria	Lone Creek	Congahbuna	Threemile
1. H_2O Quality	Low	Low	Low
2. Fish	Moderate	Low	High
3. Wildlife	Low	Moderate	Moderate
4. Reclamation	Low	Low	Low
5. Set Net	Low	Low	Low
6. Subsistence	Moderate	High	Low
7. Socioeconomic	Low	Low	Low
8. Regional Use	Low	Low	Low
9. Technical Complexity	Low	Low	Low
10. Cost	No Data	No Data	No Data

Fish

The Congahbuna site would have a lower impact than Lone Creek since it is located at least 3.2 km (2 mi) from the Chuitna River, thus making it more difficult for workers to fish. The Threemile site would have a greater impact than Lone Creek as its location would permit access to several lakes or streams with fish. Thus, the Congahbuna site was judged to have a low relative total impact value while the Lone Creek and Threemile sites were judged to have values of moderate and high, respectively.

Wildlife

Both the Congahbuna and Threemile sites would have a greater impact upon waterfowl and swans than would the Lone Creek site as they would be located close to areas used by waterfowl and swans for breeding, resting, and some migration. Therefore, the Lone Creek site was assigned a low relative total impact value while the Congahbuna and Threemile sites were assigned moderate values.

Reclamation

Technology for successful reclamation of the housing and airstrip facilities at any of the three sites exists and has been demonstrated to be effective for other Alaska projects. Therefore, each of the sites was assigned a low relative total impact value.

Set Net Fishery

No significant differences in potential impacts to the set net fishery were identified for any of the sites. Therefore, each of the sites was assigned a low relative total impact value.

Subsistence

The Congahbuna site would have potential for significantly greater impacts to subsistence than the Lone Creek site as it would be located in an area of traditional subsistence use. The Threemile site would have somewhat lower potential for impact than the Lone Creek site since it would be well removed from areas of traditional subsistence use. Thus, the Congahbuna option was assigned a high relative total impact value while the Lone Creek and Threemile options were assigned moderate and low values, respectively.

Socioeconomics

Both the Congahbuna and Threemile options would have somewhat less potential impact than the Lone Creek option since there would be less fishing in the Chuitna River by workers and the local fishing guides would not have as much competition for fish. This, however, was not considered to be a significant difference. Therefore, all three options were assigned low relative total impact values.

Regional Use

Future developments (e.g., coal) would be most likely to take place to the northwest of the Diamond Chuitna project area. The Congahbuna housing and airstrip site would be closer to these potential development sites than would be either Lone Creek or Threemile. Closer inspection, however, shows that its distance from potential developments is great enough that the site would not likely be used by other developments in the region and thus any advantage over the Lone Creek site probably would be negligible. Thus, all three sites were judged to have a low relative total impact value.

Technical Complexity

Adequate technology presently exists to design, construct, and operate all three options. Therefore, all three options were assigned a low relative total impact value.

Cost

No comparative cost data for any of the three options were made available by the applicant. Therefore, no relative total impact values have been assigned for this criterion.

Identification of Preferred Housing/Airstrip Option

The results of the comparison of housing/airstrip options described above are shown in Table 3-10. There were few significant differences among the three options. For six of the nine criteria for which data were available, all three options showed uniformly low relative total impact values. For the three criteria for which significant differences existed (fish, wildlife, and subsistence), both the Congahbuna and Threemile options received alternately higher and lower values than the Lone Creek option such that neither emerged as having an overall significantly lower potential for adverse impacts than the Lone Creek option. For example, the Congahbuna option was judged to have values of low and high, respectively, for the fish and subsistence criteria while the Threemile option received values of high and low, respectively, for the same criteria. The Lone Creek option received moderate values for both criteria.

In final analysis, therefore, there was no basis for substituting either the Congahbuna or Threemile housing/airstrip options for the applicant's preferred option at Lone Creek in any of the three alternatives.

3.3 ALTERNATIVES AVAILABLE TO THE AGENCIES

There are three alternatives available to EPA, the Corps, DNR, and other state and local agencies through each agency's permitting responsibilities. They can: 1) issue permits as proposed with standard stipulations, 2) deny the permits, or 3) issue the permits with stipulations tailored to this project which address specific impacts. Generally, the third alternative is preferable because it allows the project to proceed while minimizing the unavoidable adverse impacts.

Although it is not the purpose of this EIS to decide what stipulations the agencies should impose, it is appropriate to review the relative advantages and effectiveness of the various mitigation options which agencies may require as permit stipulations. The major mitigation options available to the agencies are discussed in Chapter 6.0.

3.4 NO ACTION ALTERNATIVE

The No Action Alternative means that development of the Diamond Chuitna project would not occur. This alternative may be used as a baseline to which the action alternatives can be compared.

The No Action Alternative would result from denial of one or more federal or state permits necessary for project development or a decision by the applicant not to undertake the project.

4.0 AFFECTED ENVIRONMENT

4.1 INTRODUCTION

This chapter describes the environment as it currently exists without the proposed project, emphasizing those environmental aspects of the Diamond Chuitna project area that could be affected by the construction, operation, and reclamation of the proposed mining and support facilities. As required by federal (NEPA) regulations, these descriptions stress the elements of the natural and human environments that are most likely to be impacted or which have been identified as likely areas of concern through the scoping process.

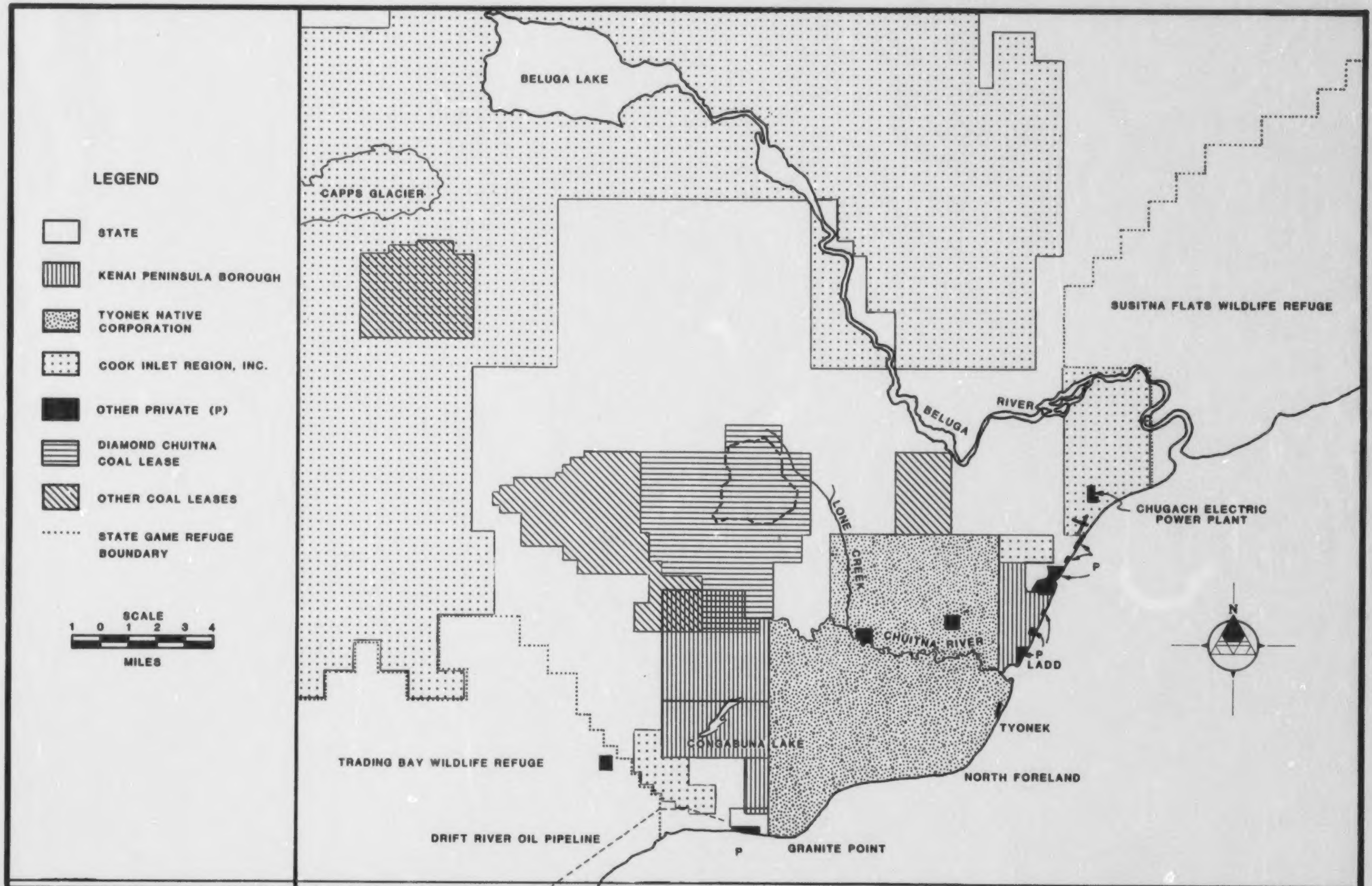
Much of the following information is derived from baseline environmental investigations that were initiated in 1982 and largely completed in 1984. Some additional work was done in 1986. The baseline study reports provide an important source of detailed information and are on file at the sites identified on page ii and in Section 7.7. The following reports are incorporated by reference into this EIS: ERT 1983, 1984a, 1984b, 1984c, 1984d, 1984e, 1984f, 1984g, 1985d, 1986; Gerlach and Lobdell 1984, 1986; Science Applications, Inc. 1984; and Riverside Technology, Inc. 1986.

4.2 REGIONAL HISTORY AND LAND STATUS

The Beluga region was first settled by Tanaina Indians who lived along the coast in the general vicinity of the present Native village of Tyonek. In 1934, the Moquawkie Indian Reservation was established for the benefit of the Natives living in the Tyonek area. In the early 1970s, reservation status ended and the Natives chose to participate as a village corporation under the Alaska Native Claims Settlement Act (ANCSA).

Exploration and development of natural resources have produced the primary impacts on the region. Major oil and gas exploration began in the early 1960s and included lands within the Moquawkie Indian Reservation. The first major permanent development in the region was the construction of Chugach Electric Association's natural gas power plant at Beluga which began operations in 1968 (Fig. 4-1).

The presence of coal outcrops in the region has been known since the early 1900s. Shortly after statehood, a major portion of the Beluga coal fields was selected by the State of Alaska under the federal government's mental health land grant entitlement. Coal exploration began in the 1960s with the first leases issued in the late 1960s. A number of coal leases exist in the region today (Fig. 4-1).


LEGEND
STATE
KENAI PENINSULA BOROUGH
TYONEK NATIVE CORPORATION
COOK INLET REGION, INC.
OTHER PRIVATE (P)
DIAMOND CHUITNA COAL LEASE
OTHER COAL LEASES
STATE GAME REFUGE BOUNDARY
SCALE
1 0 1 2 3 4
MILES
BELUGA LAKE
CAPPS GLACIER
SUSITNA FLATS WILDLIFE REFUGE
BELUGA
RIVER
LONE
CREEK
CHUITNA RIVER
CHUGACH ELECTRIC POWER PLANT
P
P
LADD
TYONEK
NORTH FORELAND
CONGABUNA LAKE
TRADING BAY WILDLIFE REFUGE
DRIFT RIVER OIL PIPELINE
P
GRANITE POINT
N

BELUGA REGION LAND (SURFACE)
OWNERSHIP STATUS

Diamond Chuitna Environmental
Impact Statement

FIGURE 4-1

In the mid-1970s, the State sold the salvage rights to a large amount of beetle-killed spruce timber west of the Tyonek Native Corporation lands. The ensuing logging operation established a road network in the area that ultimately stretched west through the Trading Bay Wildlife Refuge and across the Chakachatna River. The logs were trucked to a new facility constructed on Tyonek Native Corporation land at North Foreland where they were processed into wood chips and loaded onto ships from an elevated trestle.

There are four major landowners in the region today (Fig. 4-1). Most of the project area, including all the Diamond Chuitna lease area, the Granite Point port site, and about one-third of the southern transportation corridor, is state land as is the Trading Bay State Game Refuge to the south. In April 1985, a land use plan was adopted by DNR which designated development of coal resources as the primary management objective for their lands in the Beluga area. Most of the land east of the project area is owned or selected by the Tyonek Native Corporation, while Cook Inlet Region, Inc. (CIRI) owns the majority of the remainder of the land on the northeast, north, and west. The Kenai Peninsula Borough has either selected or received selection approval to approximately 6,249 ha (15,440 ac) around the southern portion of the southern transportation corridor just north of the Granite Point port site. In addition, the Borough owns approximately 1,416 ha (3,500 ac) along the coast between the Beluga airstrip and the Chuitna River including the Ladd port site. Title to the subsurface estate under all state and most borough lands lies with the State, while CIRI holds title to all subsurface estate under its lands, those of the Tyonek Native Corporation, and some borough lands. There are relatively few parcels of privately owned land in the region.

4.3 TERRESTRIAL ENVIRONMENT

4.3.1 Physiography, Geology, and Soils

4.3.1.1 Physiography

The Beluga region lies between the Beluga River and the Middle River and consists mainly of the broad Beluga Plateau which is of generally low to moderate relief (Schmoll et al. 1984). Streams have dissected the overburden and underlying sedimentary rock creating valleys ranging from a few tens of feet to several hundred feet in depth. Elevations range from about 49 m (160 ft) near the coast to about 427 m (1,400 ft) near the northwestern edge of the lease area. The study area has typical morainal* topography characterized by irregular ridges and depressions (ERT 1985d).

The project area is flanked on the northwest by higher portions of the plateau and adjoining foothills which rise westward toward the Alaska Range and, to the southwest, by estuarine* and alluvial* lowlands of the Chakachatna-McArthur embayment. South of the proposed mining area are lowlands covered by extensive bogs and marshes with numerous ponds and lakes. Areas near the larger streams are generally well-drained. The Beluga region is drained primarily by the Beluga and Chakachatna rivers, which are glacier-fed, and the Chuitna River which heads on the Beluga Plateau. In addition, several other streams, such as Tyonek Creek, Old Tyonek Creek, and Nikolai Creek, drain directly into Cook Inlet (ERT 1985d).

4.3.1.2 Geology

The primary regional geologic features in the area are plutonic* and volcanic* rocks and ash deposits, sedimentary rocks, and glacial deposits. Mount Spurr, an active volcano of the Alaska-Aleutian batholith*, lies about 48 km (30 mi) west of the site and has been active since at least Tertiary times. Extensive ash deposition occurred from about 3,000 to 6,000 years ago. South and west of the site, extrusive* and intrusive* igneous* rocks consisting primarily of andesites*, granodiorites*, and volcanic breccias* of Jurassic and Tertiary ages, and pyroclastics*, are exposed over extensive areas (ERT 1985d).

The central portion of the Beluga Plateau, including the project area, is characterized by a sedimentary plateau mantled by Quaternary glacial deposits. The sedimentary rocks consist of the Tertiary West Foreland Formation (noncoal-bearing) and the overlying Kenai Group. The Kenai Group consists of interbedded claystone, siltstone, sandstone, and conglomerate with numerous coal beds. Coal is also known to occur in the overlying Beluga Formation (ERT 1985d).

The coal-bearing sedimentary rocks in the lease area are part of the Tertiary Tyonek Formation of the Kenai Group. The Tyonek Formation is a sequence of fluvial* and deltaic* clays, silts, and sands with occasional gravel beds and coal seams. It is characterized by its extreme variability both laterally and vertically, with facies* and thickness changes over very short distances. Although at least 18 coal seams (including stringers*) are known to occur within the lease area, only four are thought to be of adequate areal extent and thickness to be significant for mining. The coals are of sub-bituminous* C rank, and are very low in sulfur content, ranging from 0.05 to 0.45 percent sulfur (ERT 1985d).

Five major Pleistocene glacial advances have been recognized in the Cook Inlet region; three of these have contributed to surface deposits within the Beluga region. All of the advances were characterized by dominant advances from the base of the Alaska Range at the northwest, toward lesser advances from the Kenai Peninsula on the southeast (ERT 1985d).

Thicker Quaternary deposits in the region include the embayment deposits* in the Chakachatna-McArthur River area and the Bootlegger Cove clay (ERT 1985d).

Composition of overburden, interburden, and coal seams have been extensively analyzed for plant growth suitability and water quality projections. Table 4-1 illustrates the average physiochemical characteristics of overburden and interburden material that would be encountered during mining. Sufficient quantities of selected parameters are present which accounts for the existing slightly elevated water quality concentrations discussed in the water quality section.

4.3.1.3 Seismology

Two major faults trend northeastward across the region: the Lake Clark fault to the north and the Bruin Bay fault to the south. They are believed to converge within 16 km (10 mi) northeast of the proposed mining site. There is a potential for seismic events ranging from the severe 8.5 Richter magnitude* earthquake of 1964 to short-duration, low-magnitude tremors that occur commonly throughout the Cook Inlet region (ERT 1985c).

During the 1964 earthquake, the Cook Inlet region experienced a variety of ground failures including slumping of surficial deposits toward steep unconfined slope faces, ground-water extrusion of sand and gravel, and landslides on gentle to moderate slopes resulting in tensional cracking and pressure ridges. These effects occurred near the Diamond Chuitna project area which was near the line of zero land level change (ERT 1986). According to the U.S. Army Corps of Engineers, the project area is located within Seismic Risk Zone* 4. This designation applies to areas that could be affected by earthquakes having a magnitude of 7 producing a peak acceleration of 0.4 gravity.

4.3.1.4 Soils

Surficial materials in the project area generally consist of alluvium, peat, and glacial deposits (non-homogeneous mixtures of clay, silt, sand, gravel, cobbles, and boulders) and minor amounts of loess* and volcanic ash. Alluvium is primarily found along stream drainages and consists of poorly-sorted cobbly sand to well-sorted sand and silt. Alluvial deposits are generally shallow, ranging from 3 to 9 m (10 to 30 ft). Peat deposits are found in depressions in the glacial deposits. They are characterized by accumulations of organic matter in various stages of decomposition, frequently interbedded with compacted sandy materials. Upland mineral soils are generally organic-rich

TABLE 4-1

STATISTICAL ANALYSIS OF PHYSIOCHEMICAL CHARACTERISTICS ACROSS NINETEEN DRILL HOLES IN THE DIAMOND CHUITNA MINE AREA

Statistic	pH	EC mmhos/ cm	SAR	ESP	H_2O Soluble			NH_4-DA_c Ext.						Neutralization Potential	Acid Base Account	Sulfur		
					Na	Ca	Mg	Na	CEC	As	Mo	B	Al			SO4	Pyrite	Residual
					meg/L			meg/100g		ppm				T $CaCo_3$/ 1000 T Soil				
Mean	6.3	1.1	5.0	1.8	5.99	3.85	2.25	0.31	19.5	0.12	0.35	0.18	1.02	13.6	12.5	0.01	0.01	0.03
Minimum	4.1	0.1	0.3	0.5	0.18	0.05	0.02	0.18	0.9	0.005	0.01	0.01	0.02	2.0	1.0	0.005	0.005	0.005
Maximum	8.1	3.8	48.6	7.0	33.80	30.70	24.40	1.10	69.0	2.78	1.92	2.50	293.00	38.0	35.0	0.08	0.05	0.19
Observations	335	335	125	64	365	365	365	64	199	270	336	334	365	86	86	86	86	86

	Particle Size						Saturation %	% Organic Matter	K Factor								
	Coarse Fragments	Total	Sand Coarse	Sand Fine	Silt	Clay				K	Cl	CO_3	HCO_3	SO_4	Ca	Mg	K
			%							meg/L					meg/100g		
Mean	13.2	51.3	44.4	11.0	33.9	15.0	37.3	2.3	0.40	0.36	0.41	0.18	3.80	2.74	10.02	2.79	2.30
Minimum	0.0	0.0	0.0	0.6	1.6	0.0	5.6	0.05	0.09	0.03	0.005	0.005	0.005	0.005	1.21	0.17	0.08
Maximum	64.3	98.2	89.0	51.6	84.9	54.4	89.1	14.3	0.70	5.92	2.50	2.93	23.4	15.80	25.00	12.40	11.80
Observations	219	347	135	134	352	352	333	144	137	229	199	199	199	191	64	64	64

	Se	Hg	Zn	Fe	Mn	Cu	Cd	Pb	Ni	Cr	Be	P	NH4 + NO_3	Total N %
	ppm													
Mean	0.01	0.10	10.76	119.03	20.28	6.50	0.25	3.16	5.09	0.23	0.01	2.10	14.73	0.15
Minimum	0.01	0.01	0.07	0.10	0.84	0.22	0.22	0.05	0.12	0.05	0.00	0.30	4.30	0.01
Maximum	0.01	0.67	312.00	1760.00	101.00	21.50	2.47	10.70	83.00	1.50	0.03	12.50	60.30	0.91
Observations	196	197	229	229	229	229	229	229	229	229	229	191	63	62

Source: ERT 1985C

and are typically underlain by glacially-derived soils at depths of 76 to 114 cm (30 to 45 in) (ERT 1985d).

From the agronomic point of view, the soils of the project area are composed of numerous series* that represent both organic and mineral profiles (Soil Conservation Service 1980). The relationship between soils and vegetation for the project area is shown on Table 4-2. General profile characteristics of soil units are listed in Table 4-3.

Upland soils include the Talkeetna series which consists of several sandy loam variants. The soils are loessal and volcanic in origin and overlie glacial till. Other mineral soils are associated with alluvium along streams and primarily include the Killey-Moose River complex, although Cryaquents and Histosols were also mapped on alluvial floodplains and sandbars (Table 4-2) (ERT 1984d).

Poorly drained organic soils dominate much of the project area. Starichkof taxadjunct and Chichantna soils are associated with decomposed peat and muskeg (Table 4-3). Starichkof peats are similar to the Starichkof-Chichantna soils, comprised of peat with thin layers of volcanic ash, but occur primarily near the coast. Jacobsen mucky fine sand occurs on muskeg perimeters and poorly drained swales. Thus, this series is closely associated with the Starichkof organic soils prominent in bogs and the wetter areas of muskeg.

4.3.2 Vegetation

4.3.2.1 Plant Communities

The vegetation of the project area is broadly characterized as closed spruce-hardwood forest (Viereck and Little 1972) and as bottomland spruce-poplar forest, high brush, and wet tundra (Joint Federal State Land Use Planning Commission for Alaska 1973). A complex of forest, woodland, and shrub communities has been identified within these broader life-form types by an interagency vegetation inventory (U.S. Forest Service - U.S. Soil Conservation Service 1982) and by a baseline investigation specific to the proposed Diamond Chuitna mine lease and transportation corridor (ERT 1984g).

Table 4-2 lists the major vegetation units for the project area. Forests are formed by both open (25 to 75 percent tree cover) and closed (more than 75 percent tree cover) deciduous stands, or a mixture of deciduous and coniferous species. (Scientific names of dominant plant species as determined by mean foliar cover percentage are listed in Table 4-2.) Open broadleaf balsam poplar forests occur primarily on alluvium of stream channels. White spruce usually occurs as young trees or seedlings in the understory of this

Table 4-2

MAJOR VEGETATION UNITS AND COMMUNITY TYPES AND ASSOCIATED SOIL SERIES OF THE DIAMOND-CHUITNA PROJECT AREA

Major Vegetation Units[1]	Characteristic Community Type	Associated Soil Series
Forest		
Closed Paper Birch Broadleaf Forest	Betula papyrifera/Oplopanax horridus/Cystopteris spp. Paper birch/devil's club/bladder-fern	Mutnala (Typic Cryorthods)[2]
Open Balsam Poplar Broadleaf Forest	Populus balsamifera/Alnus tenuifolia-Viburnum edule/Calamagrostis canadensis-Polypodium sp. Balsam poplar/thinleaf alder-highbush cranberry/bluejoint reedgrass-polypody fern	Killey (Typic Cryaquents)
Open Mixed Birch-Spruce Forest	Betula papyrifera-Picea glauca/Menziesia ferruginea/Polypodium sp. Paper birch-white spruce/rusty menziesia/polypody fern	Mutnala (Typic Cryorthods)[2] Spenard (Sideric Cryaquads)[2] Jacobsen (Histic Cryaquepts)
Woodland		
Mixed Spruce-Birch Woodland	Betula papyrifera-Picea glauca/Alnus sinuata-Salix novae-angliae/Calamagrostis canadensis Paper birch-white spruce/Sitka alder-tall blueberry willow/bluejoint reedgrass	Mutnala (Typic Cryorthods)[2] Talkeetna (Humic Cryorthods) Spenard (Sideric Cryaquads)[2] Jacobsen (Histic Cryaquepts)
Needleleaf Black Spruce Woodland	Picea mariana/Vaccinium uliginosum-Empetrum nigrum/Rubus pedatus-Equisetum arvense Black spruce/bog blueberry-black crowberry/five-leaf bramble-field horsetail	Starichkof (Fluvaquentic Borochemists)
Shrubland		
Closed Tall Alder Shrub Scrub	Alnus tenuifolia-A. sinuata/Calamagrostis canadensis-Polypodium sp. Thinleaf alder-Sitka alder/bluejoint reedgrass-polypody fern	Kliskon (Typic Cryaquods)[2] Talkeetna (Humic Cryorthods)
Open Tall Willow Shrub Scrub	Salix nova-angliae-S. planifolia/Calamagrostis canadensis-Rubus arcticus Tall blueberry willow-diamondleaf willow/bluejoint reedgrass-nangoonberry	Kliskon (Typic Crgaquods) Talkeetna (Humic Gryorthods)
Open Low Sweetgale Shrub Scrub/Grass Fen	Myrica gale/Carex aquatilis-Eleocharis palustris Sweetgale/water sedge-spikerush	Starichkof (Fluvaquentic Borosaprists)
Herbaceous		
Mesic Graminoid Bluejoint Herbaceous	Calamagrostis canadensis-Epilobium angustifolium-Equisetum arvense Bluejoint reedgrass-willow weed-field horsetail	Mutnala (Typic Cryorthods)[2] Talkeetna (Humic Cryorthods) Killey & Moose River (Typic Cryaquents)

[1] Follows Viereck et al. (1982).

[2] These soil types were not mapped within the lease area.

Source: ERT 1984g.

TABLE 4-3

CHARACTERISTICS OF THE MAJOR SOIL UNITS OF THE DIAMOND CHUITNA PROJECT AREA

Soil Unit	Major Profile Characteristics	Drainage	pH
Talkeetna Variant	Deep (to 1.5 m [60 in]) sandy loams with volcanic ash overlying gravelly glacial till on morainic uplands	Well	4.2-4.6
Killey Series	Silt loam in alluvial sediments overlying gravelly substrata, 76-102 cm (30-40 in)	Poor	Acidic
Moose River Series	Stratified coarse alluvium over sandy - gravelly substrata (102 cm [40 in])	Poor	Acidic
Jacobsen Series	Deep (86 cm [34 in]) fine to coarse sand over glacial till mixed with volcanic ash; very acidic	Poor	3.8-4.7
Chichantna Series	Deep (66 cm [26 in]) peat w/ coarser peat volcanic ash inclusions, interbedded coarse sand at depth	Poor to very poor	5.3-4.7
Starichkof Taxadjunct	Moderately decomposed coarse and fine peat with interbedded volcanic ash	Very poor	5.1-3.9
Cryaquents-Histosols Complex	Cryaquents-stratified sand, sandy loams and silt loams overlying coarse sand and gravel alluvium	Poor to very poor	
	Histosols-deep peat, mucky peat and muck with some stratified mineral inclusions	Very poor	Acidic

community (ERT 1984g). A similarly structured community is formed by paper birch on upland slopes and knolls. Again, white spruce is apparent in the understory. A more advanced stage in the paper birch to spruce succession is represented by a mixed white spruce-black spruce and paper birch woodland community. This type is associated with upland knolls and slopes and is abundant throughout the project area.

Woodlands (less than 25 percent tree cover) are found near black spruce on the perimeter of fens and sphagnum bogs on poorly drained soils. A mixture of white spruce and paper birch forms a second woodland community, but on uplands and slopes that have been disturbed (e.g., burned). This community is especially prominent north of the Chuitna River.

Alder thickets and willow stands are a conspicuous component of the vegetation in the project area. Thinleaf and Sitka alders form a dense tall shrub community on upland knolls and steep slopes, especially above 200 m (656 ft) elevation. A second tall shrub community is formed by tall blueberry willow and diamondleaf willow along the major stream courses of the area.

Low shrub-grass fen vegetation of sweetgale and sedges occurs as part of the muskeg-bog complex on poorly drained soils. This vegetation is scattered throughout the project area but is especially prominent south of the Chuitna River. A bluejoint grassland community is associated with openings in the white spruce-paper birch forest that has resulted from logging and beetle kill of trees (ERT 1984g). This community is considered early successional and is rich in herbaceous flora (Table 4-2). Logging activity has been especially prominent south of the Chuitna River, although recent harvesting has also occurred north of the river (ERT 1984g).

4.3.2.2 Threatened and Endangered Plant Species

No threatened or endangered plant species are known to occur in the vicinity of the Diamond-Chuitna project area (U.S. Fish and Wildlife Service 1984). Furthermore, no candidate threatened, endangered, or rare plant species is known to occur in this area (Murray 1980).

4.3.2.3 Wetlands

It has been nationally recognized that wetland habitats are a particularly valuable ecological resource and an integral part of regional hydrological regimes. Because of these special values and vulnerability to development activity, wetlands were granted special regulatory status via Section 404 of the Clean Water Act of 1977. The U.S. Army Corps of Engineers has been delegated the responsibility of regulating the discharge of dredged or fill material into wetlands. Wetlands are treated as a separate section in this report in order to emphasize their special values. The regulatory definition of wetlands found in 33 CFR 323.2 Para. c is as follows:

> "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

Wetlands within the project area have been mapped as part of the National Wetland Inventory Program (USFWS 1984). More detailed maps of wetlands within the southern transportation corridor, Granite Point port site, and 10-year mine permit area are also available. ERT (1984g) identified nine wetland types within the above area (Table 4-4). The percentage of total surface area covered by wetland communities within the study area has not been precisely determined, but is probably in the range of 20 to 30 percent. Of the nine wetland types identified by ERT, open low shrub scrub/sweetgale grass fen was the most common, especially south of the Chuitna River, where it comprised nearly 50 percent of total wetlands. Open mixed forest wetland occupied 30 percent in this area, with seven other types comprising the remaining 20 percent. North of the Chuitna River, open mixed forest wetland appeared more common than open low shrub scrub/sweetgale fen, although both clearly were more dominant than any other wetland type.

Bogs composed of a complex of the above palustrine* wetland types are common within the study area. Typically, the wetter areas are characterized by various proportions of emergent grasses and sedges and woody shrubs which grade into forested wetland types at the edge of the muskeg areas. Often open water areas are present near the center of the wetland depressions. Estuarine salt marsh and mud flat wetland types are not present within the study area but do exist in the adjacent Trading Bay State Game Refuge.

Based on federal regulations (40 CFR 230) and scientific analysis, wetland values in the project area are viewed in four broad categories. The following is a discussion for each of the value categories in order to provide a basis for assessing the wetland impacts that could result from the proposed activities.

Food Chain Production

Some kinds of wetland communities are known to produce large quantities of plant matter compared to other biological systems (Darnell et al. 1976). However, the isolated

Table 4-4

WETLAND CHARACTERISTICS IN THE MINE LEASE AREA, SOUTHERN TRANSPORATION CORRIDOR, AND PORT AREA[3]

FWS Symbol[1]	System Class Subclass[2]	Dominant Vegetation[3]	Water Regime
PF04/1	Palustrine Forested Mixed needle-leaved evergreen/broad-leaved deciduous	Open Mixed Forest/Spruce Birch;Mixed Woodland/Spruce	saturated to semi-permanently flooded Birch
PF04	Palustrine Forested Needle-leaved evergreen	Needle-leaf Woodland/Black Spruce	saturated to semi-permanently flooded
PSS1	Palustrine Scrub/Shrub Broad-leaved deciduous	Open Tall Shrub Scrub/Willow; Closed Tall Shrub Scrub/Alder	saturated to semi-permanently flooded
PSS1/EMS	Palustrine Scrub/Shrub Broad-leaved deciduous Emergent Narrow-leaved Persistent	Open Low Shrub Scrub/Sweet-gale-Grass Fen	saturated to semi-permanently flooded
PEMS	Palustrine Emergent Narrow-leaved Persistent	Mesic Graminoid Herbaceous/ Bluejoint-Herb	saturated to semi-permanently flooded
R3OWH	Riverine Upper perennial Open water	--	permanent
L1OWH	Lacustrine Limnetic Open water	--	permanent
L2AB4H	Lacustrine Littoral Aquatic Bed Floating-leaved	_Utricularia_ spp., _Sphagnum_ spp., _Nuphar_ spp., _Nymphaea_ spp., _Potamageton_ spp.	permanent
POWH	Palustrine Open water	_Utricularia_ spp., _Sphagnum_ spp., _Nuphar_ spp., _Nymphaea_ spp., _Potamageton_ spp.	permanent

---

[1] Symbols conform to those used in National Wetlands Inventory (U.S. Fish and Wildlife Service 1981)

[2] Cowardin et al. 1979

[3] Adapted from ERT 1984g

palustrine wetlands characteristic of the study area cannot be considered highly productive and probably have a lower net primary productivity* than the adjoining upland forests (Good et al. 1978). Nevertheless, these wetlands contribute substantially to the net production of organic matter that supports other ecosystem components. The plant matter produced enters the food web in a number of ways. Some animals such as insects and other invertebrates, bears, moose, and waterfowl feed directly on the vegetation. A portion of the vegetation, especially in the emergent sedge/grass communities, dies and becomes part of a decomposing mass which is consumed by bacteria and fungi which in turn is fed upon by invertebrates. Cones produced by the black spruce communities at the edges of the bogs provide a specific food source for red squirrels (_Tamiasciurus hudsonicus_) and some birds.

Habitat for Land and Aquatic Species

The wetland habitats within the study area provide openings and habitat diversity within the predominantly forested terrain and consequently enhance the value of the area to key species such as moose (_Alces alces_) and black bear (_Ursus americanus_). Ponds within the wetland depressions contribute some limited habitat for waterfowl. Sandhill cranes (_Grus canadensis_) as well as some shorebirds and songbirds utilize the muskeg areas for nesting and feeding.

Hydrology and Water Quality

Wetlands within the study area play an important role in the storage of water and the recharge of shallow ground-water aquifers (ERT 1984c). Water held in the deep organic material contributes to surface water flow in local streams. This storage capacity tends to buffer surface runoff and moderate stream flows. Enhanced winter stream flows due to ground-water input and moderate peak flows are important to successful fish production in the Chuitna River and other drainages.

Marsh and muskeg wetlands can contribute to flow of nutrients within freshwater and marine environments. Chemical reactions that occur during the process of decay within organic matter underlying wetlands cause nutrients such as nitrogen and phosphorous to be released into the water. Surface drainage distributes these nutrients to aquatic habitats. Wetlands also serve to purify waters of some trace elements and organic compounds by accumulation within the organic matter.

Recreational Use

Recreational use of wetlands within the Diamond Chuitna project area is low and incidental to area-wide activities such as moose hunting. Coastal wetlands south of the project area in Trading Bay State Game Refuge receive some use by waterfowl hunters. The limited access and subsistence orientation of local residents precludes heavy recreational use.

4.3.3 Wildlife

4.3.3.1 Birds

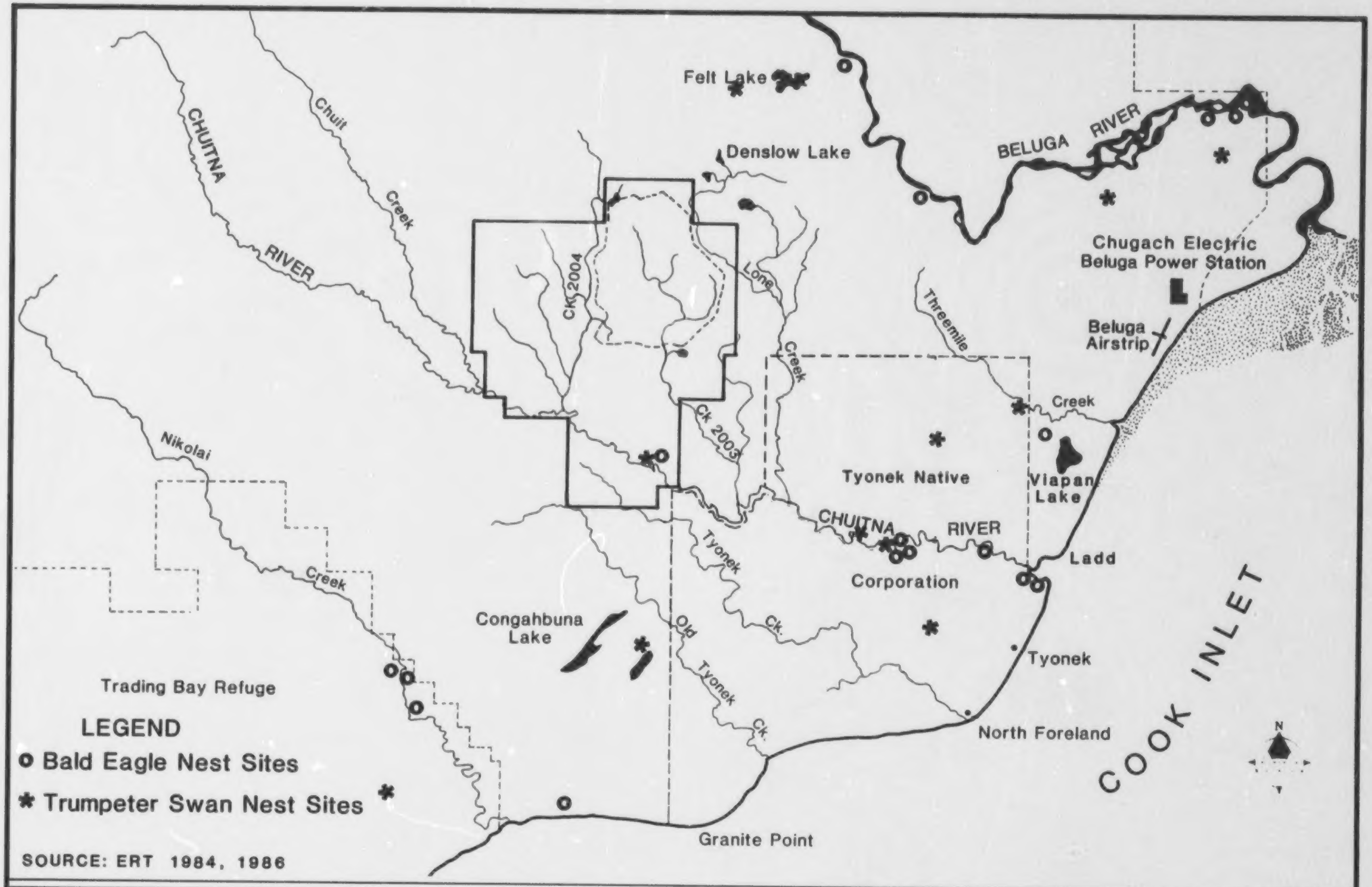
Three groups of birds are of particular interest in the project area: waterfowl, shorebirds, and raptors.

Waterfowl

Although it is flanked by important waterfowl breeding and migration areas on the south (Trading Bay State Game Refuge) and the east (Susitna Flats State Game Refuge), the project area itself contains relatively poor breeding and staging habitat for ducks and geese. Only a small area northeast of Congahbuna Lake and the bog area west of the Beluga Power Station provide significant habitat for breeding ducks (ERT 1983). During spring and fall migration, waterfowl (mainly mallards, greenwinged teal, and pintails) occur in fair numbers at the mouth of the Chuitna River and on mudflats east of the Beluga airstrip. However, neither area appears to be significant compared to other areas utilized by migrating waterfowl in Cook Inlet (ERT 1986).

The project area is of minor importance to migrating trumpeter swans (Olor buccinator), but it is bordered by important resting and feeding areas used during migration. The mine permit area and the upper portions of all transportation corridor options are seldom frequented by trumpeter swans, but one active nest site was found in 1983 adjacent to the Chuitna River crossing in the proposed southern transportation corridor (Fig. 4-4). The lower portion of the southern corridor falls within a broad band of swan nesting habitat that stretches from the Beluga River to Nikolai Creek, extending inland approximately 8 km (5 mi) from Cook Inlet (Fig. 4-2). This area includes 50 percent of the swan nesting sites within the Beluga Region (ERT 1984f). Surveys in 1986 revealed that better swan nesting habitat and greater swan use occurs north of the Chuitna River rather than along the river itself (ERT 1986).

With the exception of the portion of the southern transportation corridor option just north of Granite Point, the project area is not important for sandhill cranes (Grus canadensis). The area north of Granite Point may support


Felt Lake
Denslow Lake
BELUGA RIVER
Chugach Electric
Beluga Power Station
Beluga
Airstrip
CHUITNA
RIVER
Chuit
Creek
Nikolai
Creek
CK 2004
Ck 2003
Lone
Creek
Threemile
Creek
Tyonek Native
Corporation
CHUITNA
RIVER
Viapan
Lake
Ladd
Tyonek
Ck.
Old
Tyonek
Ck.
Congahbuna
Lake
Tyonek
North Foreland
COOK INLET
N
Granite Point
Trading Bay Refuge
LEGEND
o Bald Eagle Nest Sites
* Trumpeter Swan Nest Sites

SOURCE: ERT 1984, 1986

BALD EAGLE AND
TRUMPETER SWAN NEST SITES

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FIGURE 4- 2

two or three breeding pairs (ERT 1984f). There have been many sightings of cranes in Trading Bay State Game Refuge where a breeding pair was reported in 1981 (DOWL 1981).

Shorebirds

The project area itself is not important for migrating or breeding shorebirds or other waterbirds, but is bordered by important migration areas. The mudflats between Granite Point and Nikolai Creek, just west of the proposed Granite Point port area, are very important for migrating shorebirds (ERT 1984f). Migrating shorebirds are common at the mouth of the Chuitna River and on the mudflats east of the Beluga airstrip (ERT 1986).

Raptors

The most common raptor in the project area is the bald eagle (Haliaeetus leucocephalus). Eagles are found along the coast and the Chuitna River as far upstream as Chuit Creek during the spring, summer, and fall. They are less common along the major tributaries of the Chuitna in the mine permit area, but are regularly seen there feeding on dead salmon during the July through October spawning period (ERT 1984f).

Within the study area, 16 bald eagle nests have been located on or near three major waterways (Fig. 4-2). Seven nests are located on the Beluga River (only four of which are within the area depicted in Fig. 4-2), seven on the Chuitna River, four are on or near Nikolai Creek, and one is on the east side of Tukallah Lake. Only two nests, one on the north side of the Chuitna River near the proposed southern transportation corridor crossing and the second on the east side of Tukallah Lake, are located within the project area itself (Fig. 4-4)(ERT 1984f; Dalton 1987).

Passerines

Songbird habitat in the project area (including the transportation corridors and proposed port site) is typical of that found throughout southcentral Alaska. Common species include Swainson's thrush, alder flycatcher, ruby-crowned kinglet, orange crowned warbler, yellow-rumped warbler, blackpoll warbler, and dark-eyed junco. Most of these species nest in the area, particularly in spruce/birch forest and wet meadow habitats.

4.3.3.2 Mammals

Four species of mammals are of particular concern in the project area because of their economic, ecological, or cultural importance: moose (Alces alces), brown bear (Ursus arctos), black bear (Ursus americanus), and beaver (Castor canadensis).

Moose

Moose are common throughout the study area in spring, summer, and fall. Most calving takes place between the middle of May and the middle of June in the lowland bog and open, mixed spruce/hardwood communities below 152 m (500 ft). A majority of cows with calves remains in the area all summer because of the abundant vegetation. During that period, a sizable portion of the population, primarily bulls and cows without calves, follows the receding snowline to the open upland shrub/tundra communities above timberline (above 381 m [1,250 ft]). These animals remain there until forced down to lower elevations near the coast and along the main stem of the Chuitna River by deep snow in November and December (ERT 1984f).

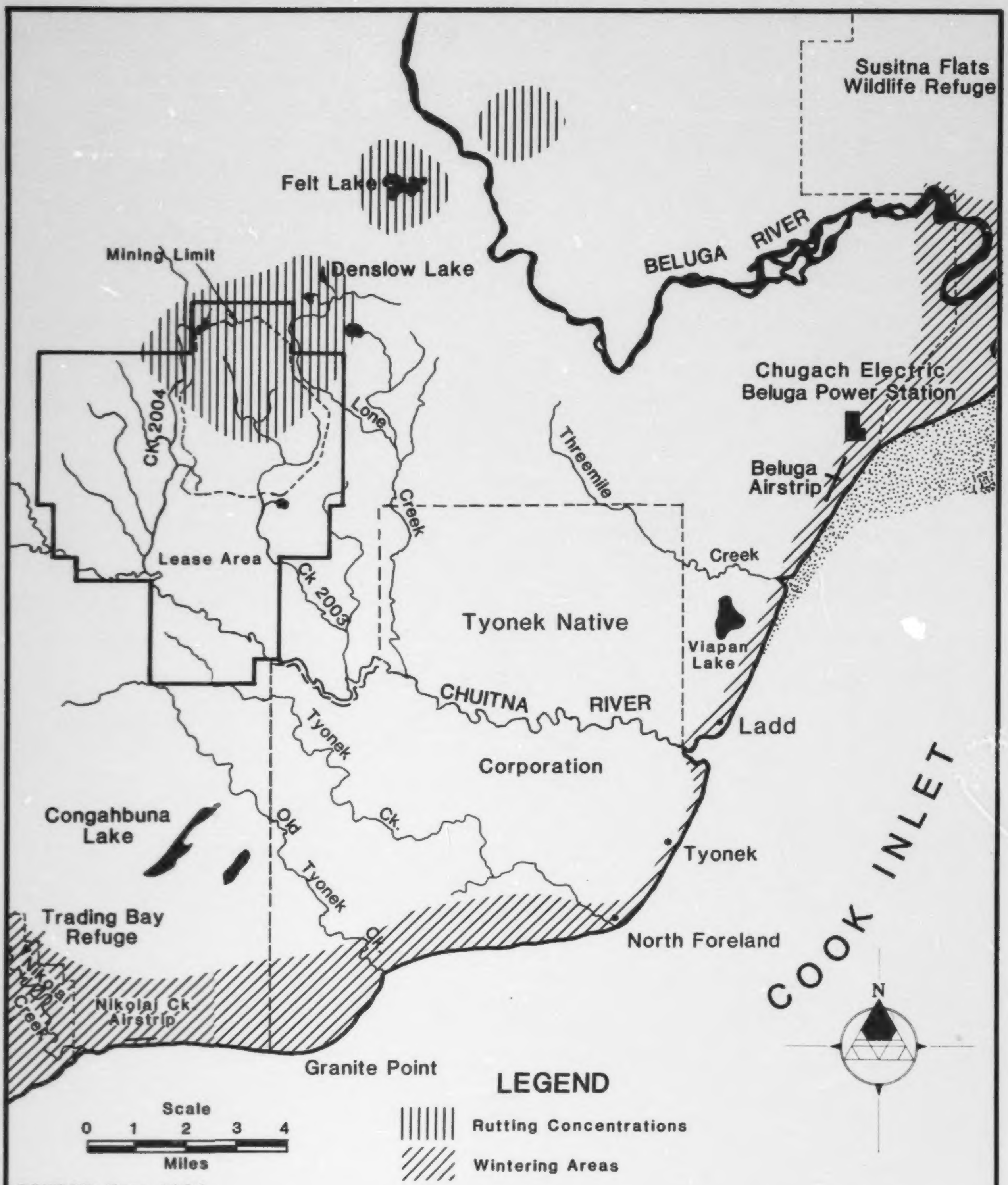
During the rut* (October/November), moose concentrate in small groups at higher elevations in the study area. One such rutting area is located south of Lone Ridge in the vicinity of Denslow Lake and the northern portion of the mine permit area (Fig. 4-3) (Faro 1985a).

In late winter, moose concentrate in the lowland flats on the south side of the Beluga River for a distance of approximately 16 km (10 mi) upriver from the mouth (Fig. 4-3). Moderate numbers of moose appear to inhabit a 3.2 to 6.4 km (2 to 4 mi) wide band stretching south from the mouth of the Beluga River along the coast of Cook Inlet to the vicinity of the Nikolai Creek escarpment and Congahbuna Lake. Small numbers of scattered moose range upstream to above the confluence of Chuit Creek in the riparian* willow habitats along the main stem of the Chuitna River. Small numbers are also found along most of Lone Creek and in the lower 3.2 to 4.8 km (2 to 3 mi) of Stream 2003. There appears to be little late winter use of the mine permit area by moose (ERT 1984f).

Moose wintering in the vicinity of Granite Point appear to spend a major portion of other seasons within the project area, including the mine permit area (Faro 1985a). A winter moose census within the study area in February 1984 estimated a population of 792 moose within the 1,343 km^2 (518.5 mi^2) area between the Beluga River and Nikolai Creek, or approximately 0.6 moose per km^2 (1.5 moose per mi^2) within the study area (Faro 1985a).

Brown Bear

Brown bears may be found throughout the study area during the spring, summer, and fall. They are likely to be found in any vegetative cover type, but generally prefer open habitats and are most common in the upland shrub and tundra communities. Brown bears are not as common in the lowlands adjacent to Cook Inlet as are black bears (ERT 1984f).


Susitna Flats
Wildlife Refuge
Felt Lake
Mining Limit
Denslow Lake
BELUGA RIVER
Chugach Electric
Beluga Power Station
Beluga
Airstrip
Ck 2004
Lone
Creek
Threemile
Creek
Lease Area
Ck 2003
Tyonek Native
Corporation
Viapan
Lake
CHUITNA RIVER
Ladd
Tyonek
Ck.
Old
Tyonek
Ck.
Tyonek
Congahbuna
Lake
Trading Bay
Refuge
Nikolai
Creek
Nikolai Ck.
Airstrip
North Foreland
COOK INLET
N
Granite Point
Scale
0 1 2 3 4
Miles
LEGEND
Rutting Concentrations
Wintering Areas

SOURCE: Faro 1984

MOOSE RUTTING CONCENTRATIONS (OCT.'83)
AND WINTERING AREAS (FEB.'84)

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FIGURE 4- 3

Food availability significantly influences brown bear distribution in the study area. Emerging grasses and herbaceous plants are critical to bears during the late spring period after leaving their dens and during early summer. From late July until as late as October, the availability of spawning salmon draws bears to the streams, often over long distances. The main stem of the Chuitna River within the project area is used very little by bears. The three major tributaries in or adjacent to the mine permit area (Lone Creek and streams 2003 and 2004), however, show substantial use by bears feeding upon salmon (ERT 1984f). In general, brown bears tend to predominate in the more open mid-level sections of these creeks while in the lower, more brushy and timbered portions, black bears appear to be more common. However, both species feed upon salmon in both areas. Seasonally, bears seem to be dispersed along the meandering, mid-elevation sections of the three creeks with no particular concentration areas identified (ERT 1984f).

In late July, berries become available and may constitute the bulk of the diet, particularly in years of heavy crops. Ripe berries can often attract bears away from accessible and abundant supplies of salmon (Erickson 1965).

Brown bears enter their dens in October or November depending upon the onset of winter. Dens are usually located at higher elevations and bears remain there until late April or May. No specific information is available on den site distribution nor does any accurate estimate exist for the size of the brown bear population in the study area. The brown bear population appears to be typical for relatively undisturbed coastal areas in southcentral Alaska.

Black Bear

Black bears may be found throughout the study area at any time of year, but they seem to prefer open, mixed hardwood/spruce forests at the lower elevations between Cook Inlet and timberline. They are commonly seen along streams and in and around bogs and clearings. Black bears do not appear to spend much time above timberline in the study area.

They generally eat the same spring and early summer herbaceous plant species as described above for brown bear, but they use a greater diversity of species. In early May, black bears feed on the emerging green vegetation found around water seeps at the base of the bluff on the north side of the canyon on the main stem of the Chuitna River (ERT 1984f). Also, black bears may be significant predators on moose calves in late spring (Miller and McAllister 1982).

Major factors affecting summer and fall black bear distribution are the abundance and distribution of berries and salmon. Since much of the salmon spawning takes place at lower elevations within their home ranges, black bears in the study area probably travel shorter distances to the streams than do brown bears (ERT 1984f). Black bears are found at lower elevations in the fall than are brown bears; denning probably also occurs at lower elevations in the mixed spruce/hardwood forests. No accurate estimate exists for the size of the black bear population in the study area, but it is probably relatively high.

Beaver

Beaver are widely distributed in the study area, from lowlands near Cook Inlet to the upland tundra/shrub communities at 503 m (1,650 ft) on top of Lone Ridge. They are most common along the major tributaries of the Chuitna River that have a low gradient (Lone Creek and streams 2003 and 2004) and in sloughs and backwater areas along the main stem of the Chuitna (Fig. 4-4). Beaver dams are a very important influence on the distribution of spawning and rearing salmon in the Chuitna River tributaries of the project area (ERT 1984f).

Beaver cache* counts show that Lone Creek has the highest number (0.70) of caches per km (1.13 per mi) of the tributary streams within the project area, followed by Stream 2004 with .49/km (.79/mi) and Stream 2003 with .26/km (.43/mi). The Lone Creek and Stream 2003 drainages also have several active lake colonies (ERT 1984f).

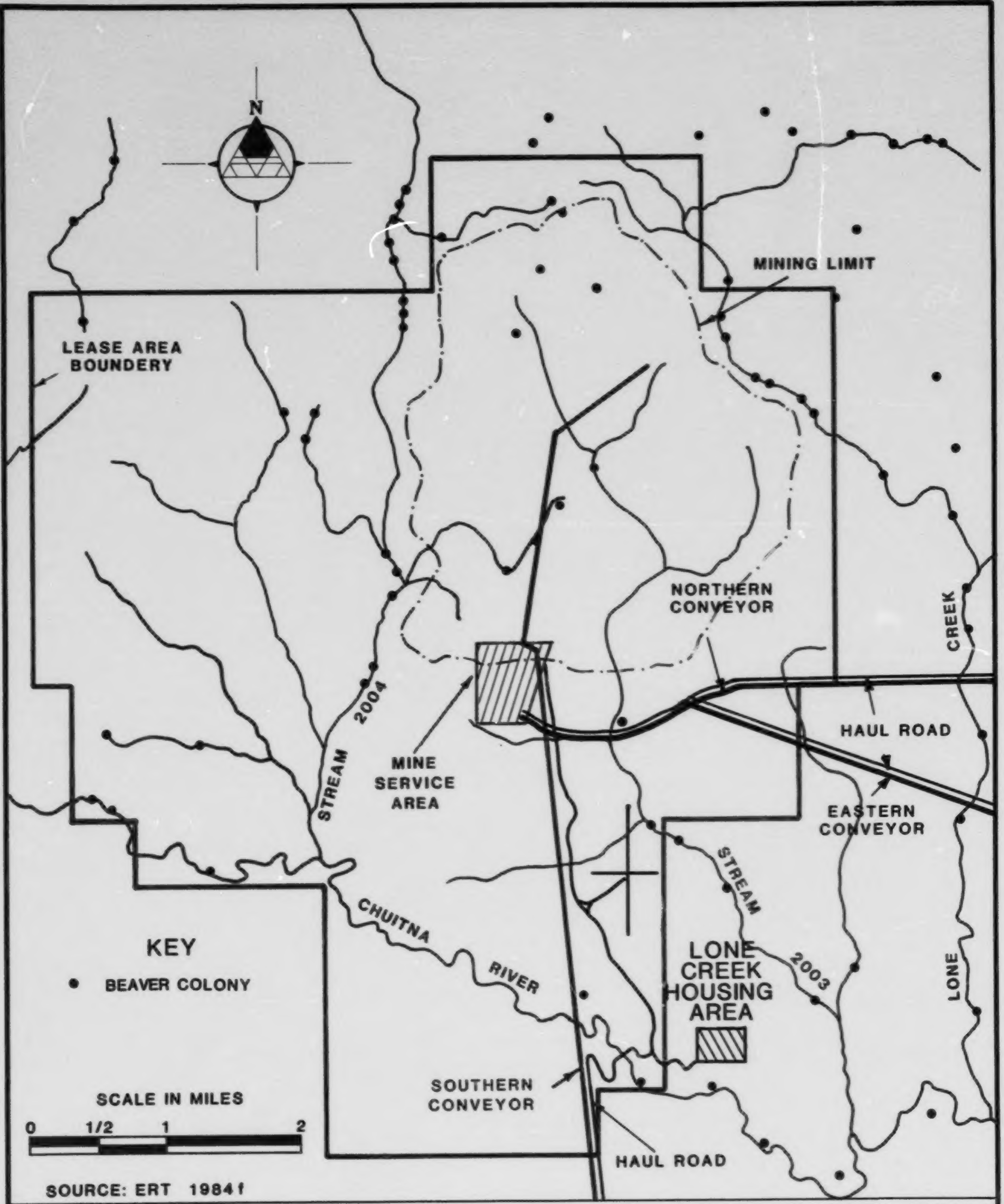
Two beaver colonies are located on Old Tyonek Creek within or immediately adjacent to the southern transportation corridor option and two more colonies exist on the large lake 1.6 km (1.0 mi) southeast of Congahbuna Lake. There are no known colonies on Tyonek Creek within the southern corridor nor in the Granite Point port area. Ten active beaver colonies occur just north of the Chuitna River (ERT 1986).

4.3.3.3 Threatened and Endangered Species

Use of the study area by threatened or endangered wildlife has not been documented. The only endangered species which may be found in the area is a subspecies of the peregrine falcon (*Falco peregrinus anatum*). The project area is at the extreme southern end of the range of this species and no suitable habitat nor any individuals have been located by surveys (ERT 1984f).

4.3.4 Habitat Value and Sensitivity

A habitat mapping and evaluation study was conducted specifically for this EIS to provide a basis for comparing habitat impacts from project alternatives as well as comparing pre- and postproject habitat values. Specific evalu-


N
LEASE AREA BOUNDERY
MINING LIMIT
STREAM 2004
MINE SERVICE AREA
NORTHERN CONVEYOR
HAUL ROAD
EASTERN CONVEYOR
CREEK
STREAM 2003
LONE CREEK HOUSING AREA
LONE
CHUITNA RIVER
SOUTHERN CONVEYOR
HAUL ROAD
KEY
● BEAVER COLONY
SCALE IN MILES
0 1/2 1 2

SOURCE: ERT 1984f

MINE AREA BEAVER COLONIES (OCTOBER 1983)

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ation species were selected that have high public interest or serve as indicator species for habitats having significant ecological value. Evaluation species were moose, brown bear, black bear, trumpeter swan, and sandhill crane. Methods and results of the analysis are summarized below and presented in detail in Appendix A.

The habitat value categories used in the analysis (Appendix A, Table 1) roughly correspond with categories in the USFWS Mitigation Policy (FR Vol. 46 No. 15, 23 Jan. 1981). In general, none of the habitats in the project area would be considered to have "very high" value (unique and irreplaceable) relative to the key species. However, some habitats with values in the "high" range are present.

Mapping of moose spring/summer/fall range (Appendix A, Fig. 7) indicates that the mixed woodland/muskeg terrain that covers the area is predominately medium quality with scattered areas of high quality shrub habitat in some riparian and adjoining zones, especially in the vicinity of Old Tyonek Creek. Moose winter habitat (Appendix A, Fig. 9) is limited by snowfall to the southwest portion of the study area at elevations less than 152 m (500 ft). Within this lower elevation area, winter habitat value is primarily medium with some scattered high quality areas interspersed. It should be noted that the Appendix A habitat evaluation is based on habitat characteristics rather than actual animal distribution. Moose studies have indicated that winter concentrations occur along the coast (Fig. 4-3) within habitats rated from low to high value. Therefore, impact analyses should consider both animal distribution and modelled habitat value when assessing impact significance.

According to the models used in Appendix A, nearly all of the study area provides high quality habitat for both black and brown bears (Appendix A, Fig. 5). A few scattered areas of medium quality brown bear habitat are also present.

Sandhill cranes represent a somewhat different situation. Little information is available upon which to base habitat ratings. The study area was divided into suitable and unsuitable (not utilized) areas (Appendix A, Fig. 1). All suitable areas were considered to have high value for cranes. Suitable areas are scattered throughout the southwest portion of the study area within selected wetlands at elevations below 152 m (500 ft).

Trumpeter swan nesting habitat is limited to lakes. Lakes within the study area are rated as high, medium, or low value swan habitat (Appendix A, Fig. 3). High quality lakes are primarily north of the Chuitna River at lower elevations.

From the standpoint of sensitivity to impacts from development, high quality habitats that exist in limited quantity would generally be considered most vulnerable since disturbance of a relatively small area could affect a substantial percentage of the available habitat. On this basis, trumpeter swan nesting lakes and moose winter range would probably be considered the most sensitive habitat types relative to the evaluation species considered in Appendix A. Additionally, nesting swans are exceptionally sensitive to human disturbance and habitat value is readily lost if humans are present (Timm 1981).

4.4 FRESHWATER ENVIRONMENT

4.4.1 Ground-water Hydrology

Detailed information on the ground-water hydrology of the area can be found in the baseline study report (ERT 1984c). The following discussion summarizes the results of that study.

Ground water within the Diamond Chuitna project permit area can be categorized in seven hydrogeologic units. These units are distinct but interrelated. Ground water within the units is either confined* or unconfined. Starting with those closest to the surface the units are described as follows:

- Recent Alluvium - Consists of the sands and gravels within the present stream channels. The sands and gravels usually have high permeability and ground water is in an unconfined aquifer.

- Overburden - Consists of coal seams, clays, sandy silts, and silty sands of the Tyonek Formation and unconsolidated surface deposits predominantly of glacial origin. The Tyonek Formation is separated from the surface deposits by an erosional unconformity*. Ground water within the Tyonek Formation is confined while ground water in the surface deposits is generally unconfined. The overburden unit is generally unsaturated beneath the ridge areas of the site. The depth to the water table varies from 0 in low-lying areas to 91 m (300 ft) or more in the northwest portion (ERT 1984c).

- Blue Coal - Mineable coal seam which is discontinuous throughout the area due to erosion. Ground water in this unit is confined.

- Red 3 Seam - A mineable coal seam, also discontinuous throughout the permit area due to erosion. This layer is saturated with water and exists under confined conditions.

- Red 2 Seam - Mineable coal seam which underlies most of the site, except a few areas where removed by erosion. Ground water in the unit is confined.

- Red 1 Seam - A mineable coal seam which is continuous throughout the permit area. The layer is saturated and exists under confined conditions.
- Sub Red 1 Sand - A thick sandstone unit which is overlain by the Red 1 Underclay. The unit is continuous throughout the permit area and is saturated under confined conditions.

The layers between the coal seams and the Red 1 Underclay act as confining tiers between the hydrogeologic units. The confining properties of the layers are variable due to sandy zones within the units and to the ability of water to move between units due to the presence of erosion channels.

Transmissivity, i.e., the rate at which water flows through an aquifer, and the thickness of each hydrogeologic unit are listed on Table 4-5. The hydrogeologic units have variable transmissivities due to differences in the physical characteristics of the rocks or the amount of fracturing within the unit.

Ground-water flow is controlled by both the local topography and by the region's structural geology. The irregular topography provides for surface-water collection and for ground-water recharge* into the underlying alluvium or overburden unit. Ground-water discharge to the stream channels occurs where the channel has cut below the local ground-water piezometric* surfaces. Faulting within the Tyonek Formation (Chuit Fault in the northwest part of the permit area and the South-Pit Fault in the southern part of the permit area) act as barriers to ground-water flow; however, evidence suggests that leakage occurs across these barriers (ERT 1984c). Folding in the Tyonek Formation combined with the erosional unconformity at its surface has resulted in the formation of several discharge and recharge boundaries, e.g., folding or erosional breaks permit water exchange with the surface or the overburden unit (ERT 1984c).

Ground-water flow in the surficial overburden unit and recent alluvial units is predominantly from higher elevations to lower elevations in the stream valleys where ground water is discharged. Ground-water flow in the remaining hydrogeologic units is predominantly from west to east with the Blue Coal and Red 3 Seam discharging some flow to surfacewater channels. The remaining (deeper) hydrologic units do not currently contribute to surface water within the study area.

Table 4-5

AQUIFER CHARACTERISTICS

HYDROGEOLOGIC UNIT	TRANSMISSIVITY (gpd/ft)[3]	THICKNESS OF UNIT m(ft)
Recent Alluvium	3,000 to 50,000[1]	0- 12.2 (0- 40)
Overburden	155 to 250,000	0-152.5 (0-500)
Blue Coal	102 to 667	4.58(15)[2]
Red 3 Seam	96 to 624	4.58(15)[2]
Red 2 Seam	58 to 815	4.58(15)[2]
Red 1 Seam	29 to 300	4.58(15)[2]
Sub Red 1 Sand	86 to 1,850	9.15(30)

[1] Estimated.
[2] Average thickness.
[3] Reported in English units to correspond with hydrological convention.

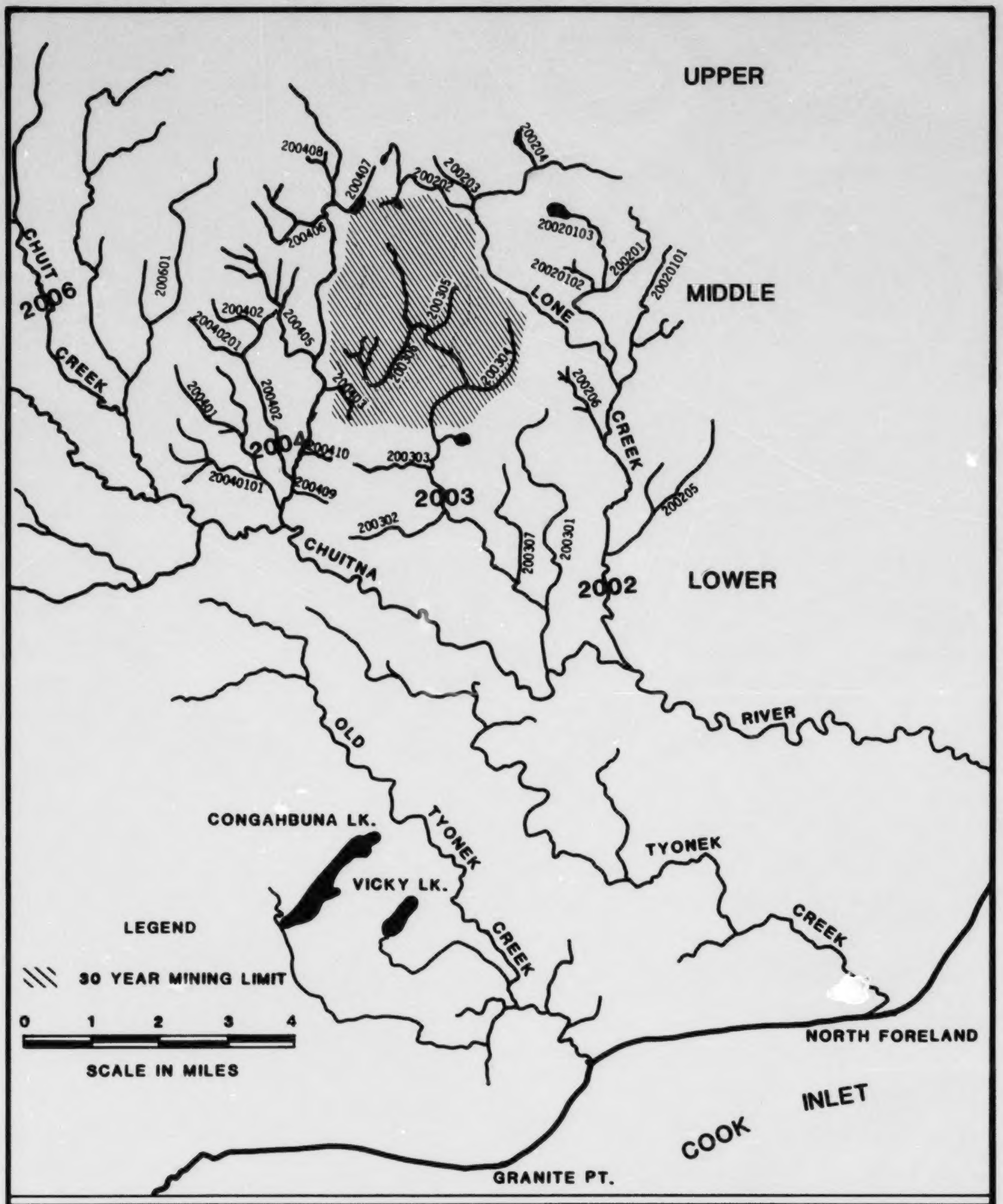
Source: ERT 1984c.

An understanding of the interrelationships between ground water and surface water is critical in providing a basis for impact assessment. Ground water contributes 34, 32, and 30 percent to the annual flows of Lone Creek, Stream 2003, and Stream 2004, respectively (ERT 1984c). At least 90 percent of this ground water is derived from the shallow overburden aquifers; the deeper aquifers contribute little to streamflow within the mine area. Muskegs are important to ground-water recharge and storage within the shallow aquifers. The stored water recharges rapidly causing flow of water in surface deposits that are ultimately drained by streams at the valley bottoms. These shallow systems on the terraced sideslopes of the project area drainages provide the majority of base flow to streams (ERT 1984c).

4.4.2 Surface Water Hydrology

The area of possible hydrologic impacts related to the project extends from the headwaters of the Chuitna River on the northwest to Cook Inlet on the southeast and to Threemile Creek on the northeast (Fig. 4-5). Upstream of the project boundary, the Chuitna River is joined by Chuit Creek, Wolverine Creek, and a number of smaller unnamed tributaries. These streams will not be affected by the proposed development.

The Chuitna River flows along the southwest side of the project area and drains a glacier-free area of about 388 km^2 (150 mi^2) over a total flow distance of about 27 km (17 mi)


UPPER
200408
200407
200204
200202
200203
20020103
CHUIT
2006
CREEK
200601
200406
20020102
200201
20020101
MIDDLE
200402
20040201
200405
200305
200306
LONE
CREEK
200401
200402
200301
200304
200206
2004
200410
200303
20040101
200409
2003
200205
200302
CHUITNA
200307
200301
2002
LOWER
RIVER
OLD
TYONEK
CONGAHBUNA LK.
VICKY LK.
TYONEK
CREEK
TYONEK
CREEK
LEGEND
30 YEAR MINING LIMIT
0
1
2
3
4
SCALE IN MILES
NORTH FORELAND
COOK
INLET
GRANITE PT.

WATERBODIES OF THE DIAMOND CHUITNA MINE STUDY AREA

Diamond Chuitna Environmental Impact Statement

FIGURE 4-5

from the northwest to southeast. Ground elevations in the basin range from sea level to approximately 549 m (1,800 ft). A short distance upstream of the project area, the streams are incised in a broad piedmont lowland that is covered with a thin mantle of poorly drained tundra vegetation.

North of the Chuitna River, the terrain is relatively flat with numerous ponds and small lakes. Larger lakes include Chuitbuna Lake, Viapan Lake and Tukallah Lake. The surface drainage in this area is poor; surface water runoff is generally to the east and south. Since the soils are nearly saturated, streams and ponds fill quickly during heavy rains (Riverside Technology, Inc. 1986).

The surface water bodies that could be affected by the proposed development include the Chuitna River and its tributaries in the vicinity of the mine area, Tyonek Creek and Old Tyonek Creek and their tributaries, and Threemile Creek. The drainage areas and estimated mean, minimum, and maximum flows of the potentially affected streams are shown in Table 4-6. Numerous lakes and ponds are also present in the study area including Congahbuna and Vicky lakes near the proposed southern corridor.

The average annual precipitation in the basin during the monitoring period 1982-83 has been estimated to be 122 cm (48 in) with evapotranspiration losses of 23 cm (9 in). Mean monthly temperatures range from a minimum of -17°C (1.5°F) in January to a maximum of 18°C (64°F) in July. In February 1983, the snow-course depth in the area varied from 58 cm (23 in) near Congahbuna Lake to 152 cm (60 in) on Chuitna Plateau, 162 cm (64 in) on Lone Ridge, and 229 cm (90 in) on Capps Plateau.

4.4.2.1 Seasonal Flow Characteristics of Affected Streams

During the winter months (November through March), below-freezing temperatures prevail in major portions of the watersheds of the streams likely to be affected by the project. Therefore, streamflows in these months are very low with lowest flows occurring in March. The period April through August is generally dry. During this time, streamflows are augmented by snowmelt and may vary from low in August to moderately high during the peak of snowmelt in late May and early June. The most significant rainfall in the area occurs in September and October. During this period, most of the streams experience high flows and flooding conditions following storm events.

4.4.2.2 Origin of Water in Surface Streams

The sources of surface runoff transported by the streams likely to be affected by the project include rain-

Table 4-6

AFFECTED STREAMS

Stream	Location	Drainage Area km^2 (mi^2)	Estimated Flows m/sec (cfs) Instantaneous Minimum	Mean Annual	Instantaneous Maximum
1. Chuitna River (Sta. C045)*	Southwest of mine area	183.81(70.97)	0.75(26.61)	5.70(203.68)	118.72(4240.16)
2. Chuitna River (Sta. C120)*	Near conveyor crossing	130.12(88.85)	0.84(29.93)	7.79(278.28)	156.80(5600.13)
3. Chuitna River (Sta. C230)*	Downstream of affected mine area	342.48(132.23)	1.77(63.36)	10.26(366.30)	189.82(6779.11)
4. Lone Creek (Sta. C220)*	Above confluence with Chuitna River	49.78(19.22)	0.13(4.73)	1.36(48.40)	25.46(908.80)
5. Unnamed Tributary 2003 (Sta. C180)	Above confluence with Chuitna River, 3.22 km (2 mi) east of conveyor and 4.83 km (3 mi) south of mine area	39.81(.15.37)	0.02(0.81)	0.71(25.37)	12.65(451.63)
6. Unnamed Tributary 2004 (Sta. C110)	Above confluence with Chuitna River, 2.4 km (1.5 mi) southwest of mine area	46.08(17.79)	0.09(3.33)	0.99(35.43)	36.76(1312.70)
7. Tyonek Creek	(a) At conveyor crossing (b) At mouth of Cook Inlet	3.89(1.5) 44.03(17.0)	-- --	0.08(3)** 0.95(34)**	-- --
8. Old Tyonek Creek	(a) At conveyor crossing (b) At mouth of Cook Inlet	2.38(0.92) 60.87(23.5)	-- --	0.05(1.8)** 1.32(47)**	-- --
9. Unnamed tributary of Old Tyonek Creek	(a) At conveyor crossing (b) At mouth	5.44(2.1) 8.81(3.4)	-- --	0.12(4.2) 0.19(6.8)**	-- --
10. Unnamed Creek south of Congahbuna Lake	(a) At conveyor crossing (b) At mouth of Cook Inlet	10.10(3.9) 12.95(5.0)	-- --	0.22(7.8)** 0.28(10)	-- --

* Based on observations from July, 1982 to August, 1983.

** Data not available. Estimated at 0.056 m^3/sec (2 cfs) per square mile.

Source: ERT 1984a

fall, snowmelt, and ground water. Using the continuous streamflow data for Station C045 and C230 on the Chuitna River for the period August 1982 to August 1983, rough estimates of the contributions of each source have been made. These estimates are based on the assumption that streamflows in September-October are contributed mainly by rainfall, those in November through March by base flows*, those in April-May by snowmelt, and those in June-July-August by snowmelt and rain. The resulting values are shown in Table 4-7.

In the absence of detailed information on the hydrology of Tyonek Creek, Old Tyonek Creek, Threemile Creek, and other streams in the area, it is assumed that contributions of rainfall, snowmelt, and ground water to the annual runoff of these streams will be of the same order of magnitude as shown in Table 4-7.

4.4.2.3 Runoff Characteristics of Affected Streams

In the Chuitna River drainage basin, surface soils have slow to very slow infiltration rates and, therefore, high runoff potential. The Soil Conservation Service Curve Number (CN) for these soils is estimated to be 61 for antecedent moisture condition* - II (AMC-II) and 78 for AMC-III. AMC-II represents the average soil moisture condition that precedes the annual flood; AMC-III represents saturated soil conditions caused by heavy rainfall or light rainfall and low temperatures during the 5 days previous to the given storm. The minimum infiltration rate for AMC-III conditions for these soils is estimated to be 0.2 cm/hr (0.08 in/hr). Estimated runoff factors for the Chuitna River basin at Station C230, downstream of the affected area, are shown in Table 4-8.

4.4.2.4 Flooding Characteristics

The maximum recorded flood on the Chuitna River near Tyonek occurred on September 20, 1976 and was estimated to be 124 m^3/sec (4,380 cfs) (USGS 1979). The drainage area of the river at this station is 339 km^2 (131 mi^2). No other data are available on the flooding characteristics of streams likely to be affected by the project. Therefore, the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year flood peaks of the streams in the project area have been estimated using synthetic methods. The peak flows and runoff volumes resulting from 24-hour storms of different recurrence intervals are shown in Table 4-9.

4.4.2.5 Channel Characteristics

Channel characteristics were observed for streams north of the Chuitna River near the existing Ladd Road. These are summarized on Table 4-10. Generally, the stream channels are 10 to 20 ft (3 to 6.1 m) wide with 2 to 3 ft (0.6 to

Table 4-7

SOURCES OF SURFACE WATER IN CHUITNA RIVER BASIN

Station	Source	Approximate percentage of annual runoff*
1. C045, Chuitna River southwest of mine area (Drainage area 183.81 km^2 [70.97 mi^2])	Rainfall	26 to 40
	Baseflow	5 to 26
	Snowmelt	22
	Snowmelt & rain	24 to 34
2. C230, Chuitna River downstream of affected area (Drainage area 342.48 km^2 [132.23 mi^2])	Rainfall	25 to 42
	Baseflow	5 to 26
	Snowmelt	20 to 34
	Snowmelt & rain	16 to 34

*Ranges are based on observed mean daily minimum flow and mean daily maximum flows.

Source: ERT 1984e

Table 4-8

ESTIMATED RUNOFF FACTORS FOR CHUITNA RIVER BASIN
(Drainage area 342 km^2 [132.23 mi^2])

Storm Designation			Estimated Runoff Factor
Return Period (years)	Duration (hours)	Depth (cm[in])	
2	24	7.59(2.99)	0.32
5	24	9.45(3.72)	0.40
10	24	12.04(4.74)	0.48
25	24	13.72(5.40)	0.52
50	24	14.38(5.66)	0.54
100	24	15.09(5.94)	0.55

Source: ERT 1984e

Table 4-9

ESTIMATED PEAK FLOWS AND RUNOFF VOLUMES FOR STORMS OF DIFFERENT RECURRENCE INTERVALS[1]

Station	Drianage Area (sq miles)	2-year 24-hour storm		5-year 24-hour storm		10-year 24-hour storm		25-year 24-hour storm		50-year 24-hour storm		100-year 24-hour storm	
		Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)
1. Chuitna River southwest of mine area C045	70.97	3,838	3,792	5,693	5,792	8,452	8,864	10,284	10,951	11,032	11,812	11,812	12,715
2. Chuitna River near conveyor crossing C120	88.85	3,966	4,711	5,918	7,175	8,859	10,977	10,854	13,584	11,642	14,624	12,525	15,795
3. Chuitna River downstream of affected area C230	132.23	4,209	6,825	6,398	10,471	9,704	16,050	11,952	19,879	12,852	21,419	13,830	23,095
4. Lone Creek above confluence with Chuitna River C220	19.22	985	1,097	1,456	1,660	2,162	2,525	2,633	3,111	2,828	3,355	3,030	3,610
5. Unnamed Tributary 1, 2 miles east of conveyor and 3 miles south of mine area C180	15.37	988	888	1,438	1,340	2,113	2,040	2,556	2,511	2,737	2,706	2,925	2,909
6. Unnamed Tributary 2, 1.5 miles southwest of mine area C110	14.79	1,126	855	1,619	1,290	2,347	1,964	2,822	2,417	3,016	2,604	3,215	2,800
7. Lone Creek east of mine area C200	7.15	562	429	808	647	1,167	981	1,403	1,207	1,498	1,298	1,599	1,396
8. Tributary of Chuit Creek west of mine area C020	2.37	218	142	308	214	440	325	526	400	561	430	597	463
9.. Tributary of Chuitna River just south of mine area, 0.7 miles east of conveyor C140	6.51	511	391	786	589	1,128	893	1,354	1,099	1,444	1,182	1,539	1,271
10. Tributary of Chuitna River south of mine area, 1.4 miles west of conveyor C080	9.42	780	566	1,115	852	1,603	1,292	1,925	1,590	2,053	1,710	2,190	1,839

[1] Reported in English units to correspond with hydrological convention.

Source: ERT 1984c

Table 4-10

STREAM CROSSING CHANNEL CHARACTERISTICS (1)
LADD ROAD/NORTH ROAD AREA

ELECTRICAL TRANSMISSION ROW

Stream Crossing	Mean Width (feet)	Bank Full Width (feet)	Mean Depth (feet)	Maximum Depth (feet)	Valley Floor Width (feet)	Roughness Characteristics	Overbank Vegetation
2003	16	32	2.0	5.0	130	Coarse Gravel/Cobble	Mixed Woodland, Shrubs, & Grasses
200301	10	22	1.0	3.5	70	Silts/Cobble	Willows, Alders, & Grasses
Lone Creek (2002)	22	41	1.5	4.0	175	Silts/Cobble/Boulder	Willows, Alders, & Grasses
15	8	12	1.0	3.0	N/A	Silt/Fine Sands	Dense Riparian, Muskeg & Grasses

LADD ROAD

Stream Crossing	Mean Width (feet)	Bank Full Width (feet)	Mean Depth (feet)	Maximum Depth (feet)	Valley Floor Width (feet)	Roughness Characteristics	Overbank Vegetation
2003	16	32	2.0	5.0	60	Coarse Gravel/Cobble	Mixed Woodland, Shrubs, & Grasses
200301	10	22	1.0	3.5	70	Silts/Cobble	Willows, Alders, & Grasses
Lone Creek (2002)	22	41	1.5	4.0	180	Silts/Cobble/Boulder	Willows, Alders, & Grasses
15	7	10	0.6	3.5	N/A	Silt/Gravel	Dense Riparian, Muskeg & Grasses
10	5	8	0.5	2.5	N/A	Sand/Gravel	Dense Riparian, Muskeg & Grasses

(1) Values are composite of mulitple surveys conducted during baseline studies and are representative of the selected stream crossings.

0.9 m) vertical banks. They are well-developed, incised and V-shaped. Dense riparian vegetation and woodland comprise overbank vegetation. In the Chuitna River basin, channels appear to be dynamic and have potential for bank collapse and migration due to extreme runoff events. For flood events, less than bankfull, very little bank alteration would likely occur since they are held together by a heavy vegetative mat in most cases. Large streambed materials and low natural sediment content of the water minimize aggradation and degradation (Riverside Technology, Inc. 1986).

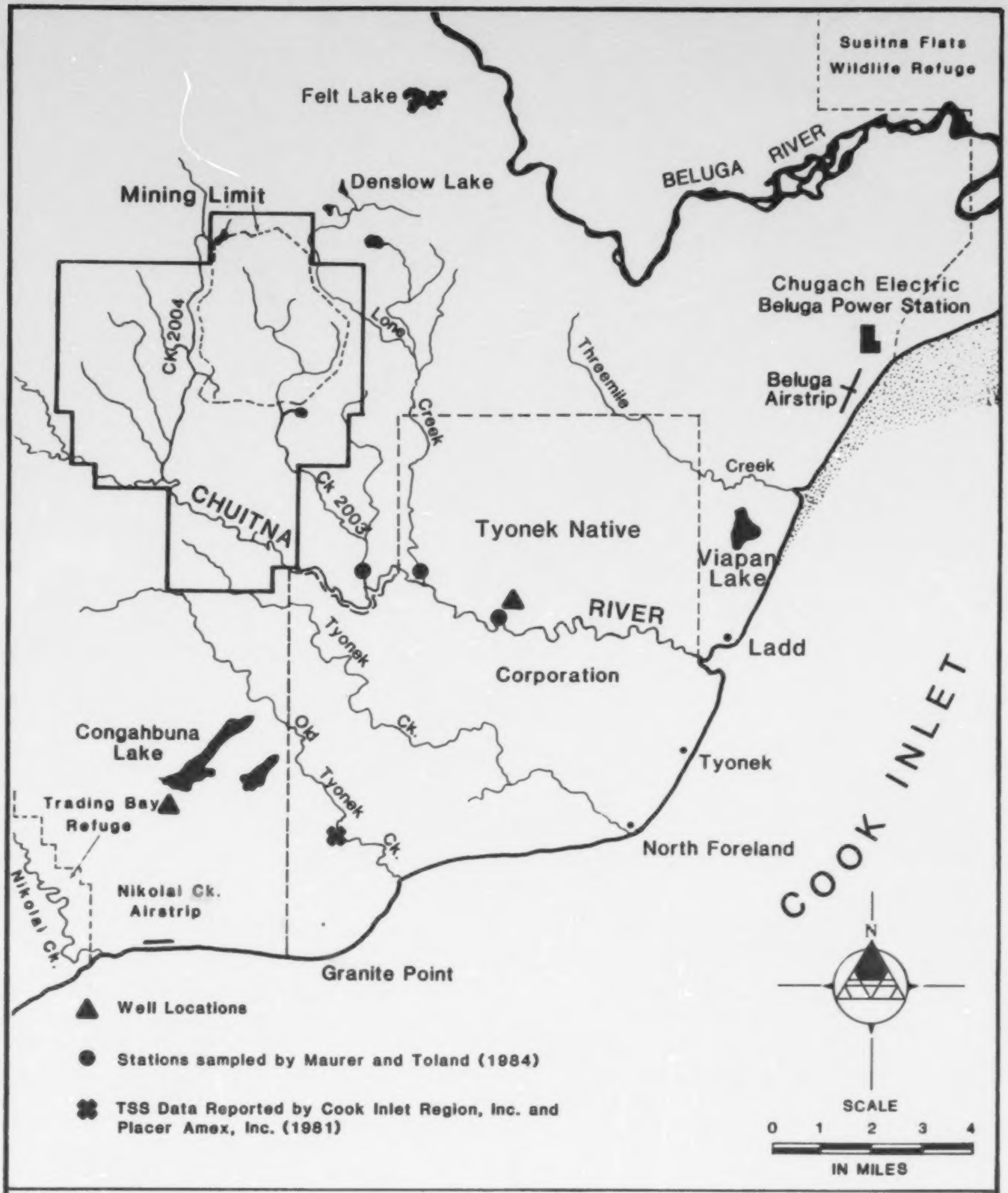
4.4.3 Water Quality

4.4.3.1 Ground-water Quality

Two wells drilled in the project area (Fig. 4-6) provide information about ground-water quality outside of the lease boundary. The well southwest of Congahbuna Lake had good quality soft water that was a mixture of calcium bicarbonate and sodium bicarbonate types (DOWL 1981). Water contained low mineralization, trace element concentrations were low, and the water easily met drinking water standards (ADEC 1982). Water in a well near the Chuitna River was calcium bicarbonate type (Scully et al. 1981). Other than iron, no physical constituents or properties were in excess of the EPA (1976) or ADEC (1982) drinking water standards.

Ground-water quality in the lease area, summarized in Table 4-11, was characterized by sampling numerous test wells. This water exhibits significant variation with depth or stratigraphic position of each hydrogeologic unit (ERT 1984a). The water quality of springs is similar to stream water quality and meets all of the primary drinking water standards. Mineralization (measured by total dissolved solids and conductivity), hardness, pH, and alkalinity tend to increase with the older and deeper units. Ground water from all units, except springs, exceeds the drinking water criteria for iron and manganese and the total dissolved solids criterion is exceeded in the Sub Red 1 Sand (ADEC 1982). Iron concentrations in all units, except springs, also exceed the level critical for the preservation of freshwater aquatic life, which is 1.0 mg/l (EPA 1976). Isolated ground-water samples also equalled or slightly exceeded aquatic life criteria for zinc and ammonia. Trace elements other than iron and manganese exhibit low concentrations, as do the EPA priority pollutants.

The water quality of the upper part of Lone Creek appears to be slightly affected by discharge of ground water originating from the deeper aquifers. Ground-water input to other streams is primarily from shallow aquifers with water quality similar to surface water and, therefore, water quality differences cannot be detected (ERT 1984c).


Susitna Flats
Wildlife Refuge
Felt Lake
Denslow Lake
Mining Limit
BELUGA RIVER
Chugach Electric
Beluga Power Station
Beluga
Airstrip
Ck 2004
Lone Creek
Threemile Creek
CHUITNA RIVER
Ck 2003
Tyonek Native
Corporation
Viapan
Lake
Ladd
Tyonek Ck.
Old Tyonek Ck.
Congahbuna
Lake
Trading Bay
Refuge
Tyonek
North Foreland
COOK INLET
Nikolai Ck.
Nikolai Ck.
Airstrip
Granite Point
N
▲ Well Locations
● Stations sampled by Maurer and Toland (1984)
✖ TSS Data Reported by Cook Inlet Region, Inc. and Placer Amex, Inc. (1981)
SCALE
0
1
2
3
4
IN MILES

WATER QUALITY SAMPLE STATIONS

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FIGURE 4-6

Table 4-11

GROUND-WATER QUALITY

Characteristic	Spring	Aluvium	Over-burden	Blue Coal	Red 3 Coal	Red 2 Coal	Red 1 Coal	Sub Red 1 Sand
Conductivity, micromhos/cm @ 25°C	44	180	250	280	400	590	580	910
Hardness, mg/L as $CaCO_3$	8.9	66	100	94	75	102	104	134
Dominant Cation	Ca/Na	Ca	Ca	Ca	Na	Na	Na	Na
Dominant Anion	HCO_3	HCO_3	HCO_3	HCO_3	HCO_3	HCO_3	HCO_3	CO_3
Sulfate, mg/L	1.9	5.0	5.8	21.2	2.5	38.9	39.7	5.9
Iron, mg/L	<0.02	3.5	5.1	2.1	2.1	12.1	39.7	3.7
Manganese, mg/L	<0.005	0.19	0.39	0.29	0.08	0.16	0.72	0.15
Zinc, mg/L	0.045	0.24	0.23	0.41	0.22	2.24	2.51	3.39
Trace Elements (other than Fe, Mn, & Zn)	Low	Low	Low	Low	Low	Low	Low	Low
Total Aromatic Hydrocarbons	Low	Low	Low	Low	Low	Low	Low	Low
Acid Extractables	Low	Low	Low	Low	Low	Low	Low	Low
Base/Neutral Extractables	Low	Low	Low	Low	Low	Low	Low	Low

Note: Values are averages for each unit.
Iron, manganese, and zinc concentrations are total recoverable levels.

Source: ERT 1984c.

4.4.3.2 Surface Water Quality

Data reported by Scully et al. (1981), ERT (1984e), and Maurer and Toland (1984) indicate that the water quality of streams in the Chuitna River basin (Fig. 4-5) is consistently high throughout the year, which is typical in pristine areas of Alaska. The stream flow is typically highly oxygenated with 90 to 100 percent saturation of dissolved oxygen and has little or no oxygen demand. The water displays neutral pH levels but low concentrations of alkalinity indicate the streams are poorly buffered. Mineralization is low as indicated by relatively low conductivity levels, ranging up to 120 micromhos per centimeter at 25°C (77°F). The dilute surface waters are a calcium bicarbonate type, have low concentrations of nutrients, and only a small amount of natural organic enrichment.

Breakup occurs in late April or early May. In May and June, water temperatures exhibit a moderate increase followed by a more rapid increase in late June and July. The annual maximum water temperature occurs in late July or early August and the maximum temperature recorded was 22.5°C (72.5°F) (Scully et al. 1981). Water temperatures decrease throughout September and usually reach near the freezing point by late October.

Total suspended solids concentrations have ranged up to 1570 mg/l in the Chuitna River (Scully et al. 1981). Total suspended solids concentrations and turbidity levels, however, are consistently low over a wide range in discharges on the smaller streams. In the Chuitna River, 86 percent of the suspended sediment is discharged during 10 percent of the time. Further, particle size analyses show that 30 to 70 percent of the suspended sediment consisted of sand particles and the rest was silt and clay (Scully et al. 1981).

Although iron and manganese concentrations exceed their respective drinking water criteria (EPA 1976; ADEC 1982) much of the time, concentrations of other trace elements are low. These constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, titanium, zinc, and uncomplexed cyanide. Background concentrations of boron, nickel, and zinc are low, but have been found to occasionally exceed standards for aquatic life. Organically derived ammonia nitrogen is also found to periodically exceed recognized standards. Recoverable iron has ranged up to 6.1 mg/l (Maurer and Toland 1984), with most of the measurements exceeding 1.0 mg/l--the level critical for the preservation of freshwater aquatic life (EPA 1976).

Radioactivity levels determined as gross alpha and gross beta on all samples were below the drinking water limits (EPA 1976).

Volatile organics, acid extractables, and base/neutral extractables were consistently less than their respective detection limits. This information indicates that there is no evidence of herbicides, pesticides, and other organic chemical contamination in these streams.

Limited water quality data exist for Threemile, Tyonek, and Old Tyonek Creeks. Four total suspended solids measurements in Old Tyonek Creek ranged from 2.1 to 19.0 mg/l (DOWL 1981), indicating a relatively low sediment load in this creek. U.S. Geologic Survey data (USGS 1981; USGS 1983; Still et al. 1984) indicate all three creeks display relatively low conductivity levels. Hence, mineralization is low. Water temperature ranges from 0 to at least 20°C (32° to 68°F), dissolved oxygen levels are moderately high to high, and pH values are typically neutral. Bicarbonate alkalinity concentrations are relatively low which means there is little buffering capacity in these creeks. Color levels in Tyonek and Old Tyonek Creeks are high.

4.4.4 Biology

4.4.4.1 Aquatic Ecology

There are four relatively distinct freshwater habitat types in the project area: the Chuitna River, the three tributaries to the Chuitna, Threemile Creek, and numerous ponds and small lakes (Fig. 4-5). Most of these habitats are relatively productive, supporting a diverse array of primary and secondary producers (algae and invertebrates). Where access has been available since the last ice age, resident fish have colonized many of these waters. Where access is currently possible, anadromous* fish dominate the aquatic communities.

For its lower 10 km (6 mi), the Chuitna River meanders over the relatively flat coastal plain that extends northward past the Susitna Flats. At a point about 1 km (0.6 mi) downstream of the mouth of Lone Creek, the river leaves a steep-walled valley and the sinuosity is somewhat reduced. Overall, the stream is characterized by long riffle sections interspersed with scattered deep pools. The entire mainstem through and above the project area is accessible to adult anadromous fish and is also utilized by juveniles for rearing (ERT 1984a). Substrate ranges from coarse sand to cobble and boulder with bedrock outcrops, often in the form of coal seams. Water is typically clear (non-glacial) and slightly stained with organics. Benthic productivity, as evidenced by standing crop, tended to be less than in the mine area tributaries. Mean annual flow has been estimated at 5.70 to 10.26 m^3/sec (203.68 to 366.30 cfs) with a recorded extreme range of flow of 2.41 to 112.00 m^3/sec (86 to 4,000 cfs)(ERT 1984e).

Three significant Chuitna River tributaries drain portions of the mine area. These tributaries, 2002 (Lone

Creek), 2003, and 2004, contribute 15, 7, and 10 percent, respectively, of Chuitna flow below the Lone Creek confluence (ERT 1985c). In addition, Tyonek and Old Tyonek creeks would be crossed by the southern corridor. The northern corridor crosses Lone Creek and crosses Threemile Creek twice. The eastern corridor crosses Lone Creek. In general, these streams can be characterized as clear-water streams with moderate to high organic staining, stable channels and flows, good benthic productivity, and good to excellent fish habitat. The benthic community is dominated by immature stages of chironomids (mosquitoes and midges), simuliids (black flies), mayflies, caddis flies, and stoneflies with species dominance shifting with time during the open water season (ERT 1984a).

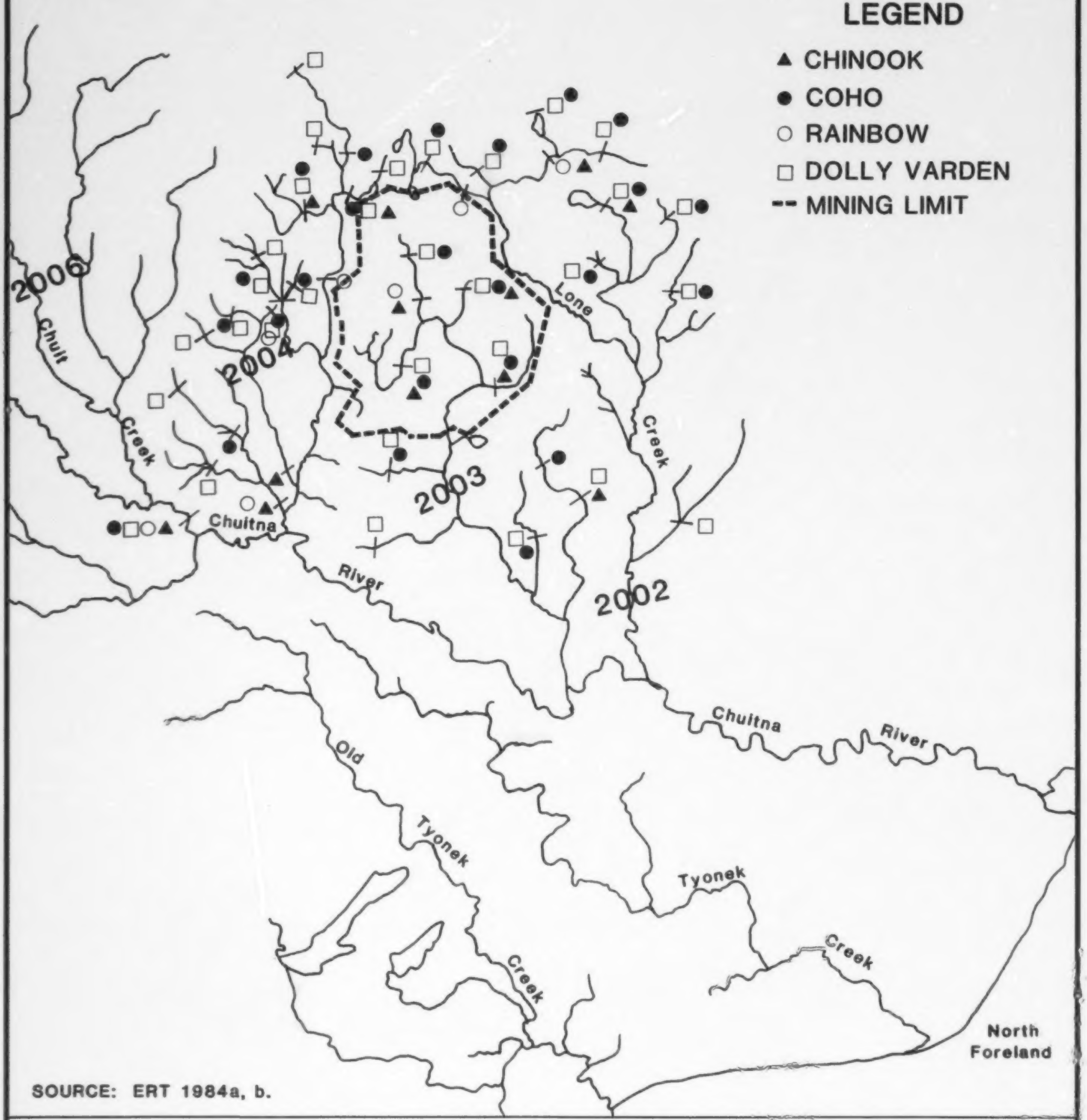
The mine area contains numerous small ponds and lakes in various stages of eutrophication. Most are being encroached upon by vegetative growth that will eventually turn them into boggy muskeg. Only a few of these lakes have been shown to support fish, primarily because of limited access or limited spawning or overwintering areas. Benthos and zooplankton densities and diversities measured in these lakes appeared low (ERT 1984a); however, sampling in July likely missed periods of peak abundance.

4.4.4.2 Fish

Freshwater habitats in the project area support abundant resident and anadromous fish populations that have significant subsistence, commercial, and sport value (see also Sections 4.5.3, 4.8, and 4.10.1). The distribution of fish and spawning and rearing habitat within the study area are shown in Figures 4-7 and 4-8.

At present, resident species are not significantly exploited in project area streams. Limited numbers of both resident rainbow trout (Salmo gairdneri) and anadromous Dolly Varden char (Salvelinus malma) are taken as incidental catch in the salmon sport fishery in the lower Chuitna (ADF&G 1983, 1984). Possibly the most important resident species is the rainbow trout. The mainstem of the Chuitna River, particularly upstream of Stream 2004, contains a population of modest-sized (e.g., to 1 kg [2.2 lb]) rainbows that would be capable of supporting a limited, but high-quality, sport fishery (Dames & Moore 1980). Limited access and availability of other fishing opportunities have prevented development of such a fishery to date. Juvenile rainbow trout, and perhaps smaller adults, are widely scattered but not abundant in the tributary streams draining the mine area (ERT 1984a, 1985c).

Dolly Varden are the most widespread of the salmonids found in the study area, occurring in both resident and anadromous forms. In 1983, in excess of 3,000 anadromous Dolly Varden were counted entering the system (Table 4-11;

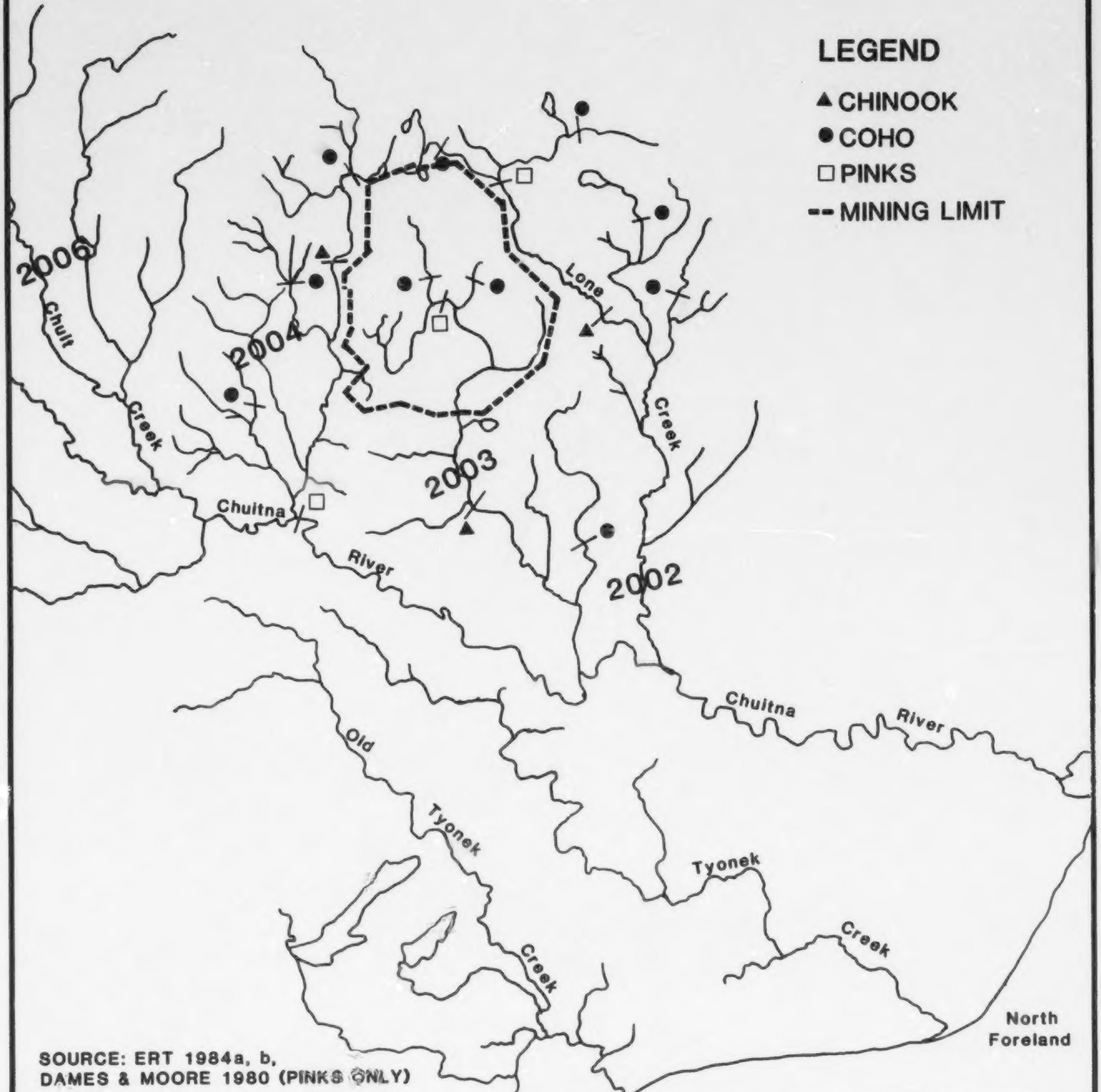

LEGEND
▲ CHINOOK
● COHO
○ RAINBOW
□ DOLLY VARDEN
-- MINING LIMIT
2006
Chuit
Creek
2004
2003
2002
Lone
Creek
Chuitna
River
Chuitna
River
Old
Tyonek
Creek
Tyonek
Creek
North
Foreland

SOURCE: ERT 1984a, b.

UPPERMOST EXTENT OF DOCUMENTED USE BY REARING JUVENILE SALMONIDS

Diamond Chuitna Environmental Impact Statement

FIGURE 4-7


LEGEND
▲ CHINOOK
● COHO
☐ PINKS
-- MINING LIMIT
2006
Chuit
Creek
2004
2003
2002
Lone
Creek
Chuitna
River
Chuitna
River
Old
Tyonek
Creek
Tyonek
Creek
North
Foreland

SOURCE: ERT 1984a, b,
DAMES & MOORE 1980 (PINKS ONLY)

UPPERMOST EXTENT OF DOCUMENTED USE BY SPAWNING ANADROMOUS FISH

Diamond Chuitna Environmental Impact Statement

FIGURE 4-8

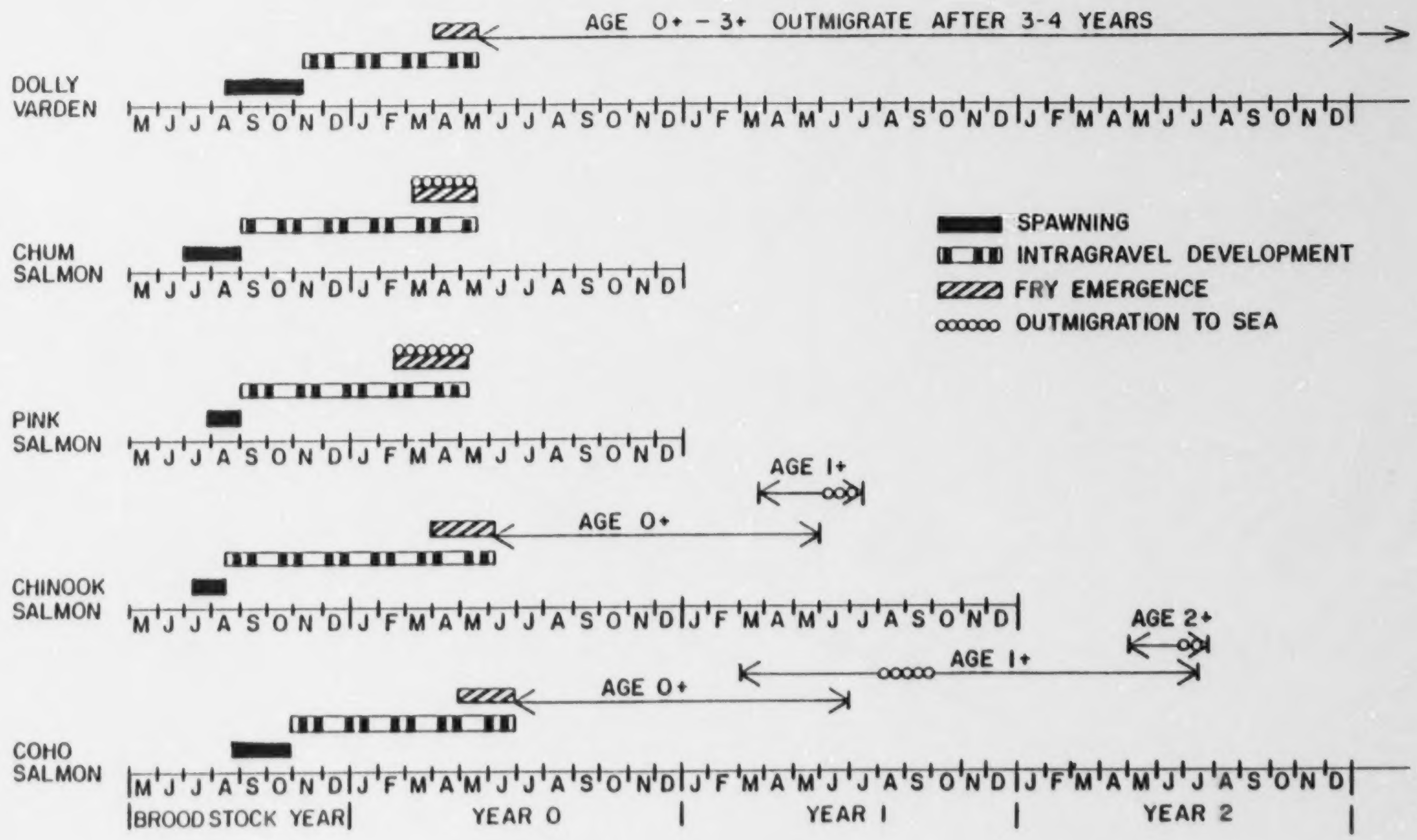
ERT 1984c). Juveniles were taken at virtually every stream location sampled that had any fish, including the uppermost reaches of tributaries to streams 2002, 2003, and 2004 (ERT 1984a, Dames & Moore 1980).

Other resident fish that have been taken in the Chuitna system include Pacific lamprey (*Lampetra tridentatus*), arctic lamprey (*L. japonica*), slimy sculpin (*Cottus cognatus*), coastrange sculpin (*C. aleuticus*), and threespine stickleback (*Gasterosteus aculeatus*, primarily a lake resident) (ERT 1984a).

By far the greatest fishery value of the Chuitna System is represented by the production of anadromous Pacific salmon, especially chinook (king) and coho (*Oncorhynchus tshawytscha* and *O. kisutch*). Pink salmon (*O. gorbuscha*) are also abundant in the system along with a few chum and red (sockeye) salmon (*O. keta* and *O. nerka*, respectively). Timing of key life history phases of important salmonids in the Chuitna System is presented in Figure 4-9. Documented spawning escapements* of chinook, coho, and pinks to the Chuitna system and to mine area tributaries are provided in Table 4-12. Chum escapements are not well documented, but are likely less than a hundred fish annually (ERT 1984a). Small numbers of red salmon are taken each year in the chinook fishery in the lower Chuitna (ADF&G 1983, 1984b).

Maturing adult chinook salmon enter the Chuitna River from mid-June through early July on their spawning migration. Estimated escapements in the three years of baseline data ranged from 3,537 to 6,000. Spawners were noted as far upstream as 6.5 km (4 mi) above the mouth of Wolverine Creek in the mainstem. Chinook spawners were documented as far upstream as 10, 5.6, and 7 km (6.2, 3.5, and 4.4 mi) above the mouths of streams 2002, 2003, and 2004, respectively, in at least one of the three baseline survey years (Table 4-12, Fig. 4-8). Maximum percentage of the documented chinook escapement for the Chuitna system spawning in each creek has been 7, 14, and 8 percent, respectively. Upstream extent of chinook spawning in these three streams has declined progressively from 1982 through 1984. Upstream migration distance, and very likely escapement numbers to each stream as well, is dependent in each year on the location of impassible beaver dams.

Chinook spawn in the study area from early July through mid-August (Fig. 4-9). Preferred spawning habitat is gravel and cobbles with a tendency toward use of coarser stream bed areas. Measured spawning area water velocities ranged from 0.27 to 0.46 m/s (0.9 to 1.5 ft/s) in depths of 25 to 35 cm (0.8 to 1.1 ft) (ERT 1985c). Emergence reportedly occurs throughout April and May (Fig. 4-9). Fry usually spend one year in the stream, residing primarily in the main Chuitna and the middle and lower sections of the tributaries and feeding on a mixture of terrestrial adult and immature



SOURCE: ERT, 1985

TIMING OF LIFE HISTORY PHASES FOR ANADROMOUS SALMONIDS IN THE CHUITNA RIVER DRAINAGE

Diamond Chuitna Environmental Impact Statement

FIGURE 4–9

Table 4-12

SALMON ESCAPEMENT TO THE CHUITNA RIVER AND PROJECT AREA TRIBUTARIES

	CHINOOK				COHO				PINK				DOLLY VARDEN			
STREAM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM
CHUITNA SYSTEM 20	1982	to mouth of 2011 (Wolverine Fork)	3537 to 4119	100	1982	not documented	1085 to 1500	100	1980	to 2 mi. below mouth of 2004	N.E.	N.E.	1982	not documented	N.E.	-
	1983	to 4 mi. above mouth of 2011	5750 to 6000	100	1983	to 4 mi. above mouth of 2011	1600 to 1800	100	1982	to mouth of 2004	20,410+	100	1983	above mouth of Wolverine Creek	3328+	100
	1984	to mouth of 2011 (Wolverine Fork)	3900	100	1984	not documented	1900 to 2500	100	1983	to mouth of 2004	7150	100	1984	not documented	N.E.	-
									1984	to mouth of 2004	9775 mainstem only	unknown				
LONE CREEK 2002	1982	to 0.5 mi. above 200201	200+	5 - 6	1982	to above 200204 (Denslow Lake)	130+	9 - 12	1980	to mouth of 200202	several thousand					
	1983	to 0.8 mi. above mouth	338+	7	1983	to 2 mi. above 200201	312	17 - 19	1982	to 0.5 mi. above 200205	N.E.	N.E.				
	1984	to 0.8 mi. above mouth	224	7	1984	to just below 200204; 0.5 mi. into 200202	446	18 - 23	1983	to 0.8 mi. above mouth	225	3				
									1984	to 0.8 mi. above mouth	324	3				
WATERSHED 2003	1982	to near mouth of 200302	508	12 - 14	1982	not documented	70+	5 - 6	1980	to just below mouth of 200306	5000?	N.E.				
	1983	to near mouth of 200302	325	6 - 7	1983	to just above 200306	141	8 - 9	1982	not documented	N.E.	N.E.				
	1984	to 1.0 mi. above of mouth	41	1	1984	to mouth of 200306; 0.4 mi. into 200305		5 - 7	1983	to 0.8 mi. above mouth	<50	4				
									1984	to 0.8 mi. above mouth	N.E.	N.E.				
WATERSHED 2004	1982	to 1.0 mi. above 200405	280	7 - 8	1982	documented only in 200405	100+	7 - 9	1980	none seen	0	0				
	1983	to just below 200403	81+	2	1983	to mouth of 200406	144	8 - 9	1982	none seen	N.E.	N.E.				
	1984	to 0.5 mi. above mouth	9	<1	1984	to mouth of 200406	86	3 - 5	1983	none seen	0	0				
									1984	none seen	0	0				

Source: ERT 1984a, 1984b; Dames & Moore 1980 aquatic insects (ERT 1984a). Outmigration probably occurs during the spring but may extend from March through July (ERT 1985c). Late fall migrations out of the smaller tributaries may occur but have not been well studied. Overwintering distributions are also not fully defined.

Maturing adult coho salmon enter the Chuitna River from late July into September on their spawning migration. Coho spawners have been noted as far upstream as 5.6 km (3.5 mi) above the mouth of Wolverine Creek in the mainstem and some 11 km (7 mi) up Chuit Creek (ERT 1984a). Coho spawners also were documented as far upstream as 17.6, 11.5, and 9.6 km (11, 7.2, and 6 mi) above the mouths of streams 2002, 2003, and 2004, respectively, in at least one of the three baseline survey years (Fig. 4-8). Maximum percentage of the documented coho escapement for the Chuitna system spawning in each creek has been 23, 9, and 9 percent respectively. Upstream migration distance and escapement to each stream do not seem to be as dependent on the location of beaver dams as for chinook and pink salmon.

Coho spawn in the study area from late August through October (Fig. 4-9). Preferred spawning habitat is a gravel or gravel/cobble stream bed in 27 to 30 cm (10.6 to 11.8 in) of water with a velocity of 0.34 to 0.43 m/s (1.1 to 1.4 ft/s) (ERT 1985c). Emergence reportedly occurs from late April through June. Fry spend one or two years in the stream residing mainly in pools and slower reaches of accessible tributaries. They feed on a mixture of terrestrial adult insects that fall into the water and immature aquatic insects (Scott and Crossman 1973, Dames & Moore 1976). Outmigration probably occurs primarily during the spring but may extend throughout much of the year (Fig. 4-9). As with chinook salmon, late fall migrations and overwintering distributions are not well understood.

Maturing adult pink salmon enter the Chuitna River from mid-July through early August on their spawning migration. Estimated escapements in the three years of baseline ranged from 7,150 to over 20,400, with greater numbers during even-numbered years. Spawners were noted only as far upstream as the mouth of Stream 2004 in the mainstem. Pink spawners were documented as far upstream as 4.7 and 1.3 km (2.9 and 0.8 mi) above the mouths of streams 2002 and 2003, respectively, in at least one of the three baseline survey years (Table 4-12). Maximum percentage of the documented pink escapement for the Chuitna system spawning in each creek has been 3, 4, and 0 percent, respectively. However, in an earlier survey, during the exceptionally good 1980 pink year, pink spawners were far more abundant (Table 4-11) in streams 2002 and 2003 than during the baseline study years (Dames & Moore 1980). Spawning activity was noted as far upstream as 11.4 km (7.2 mi) above the mouth of Stream 2003. In Lone Creek (2002), pinks were seen as high as 14.6 km (9.1 mi) above the mouth (at the confluence of 200202) in

1980 (Dames & Moore 1980). As with chinook, upstream migration distance, and very likely escapement numbers to each stream as well, is very dependent on the location of impassible beaver dams; a trend of increasing exclusion from upper reaches of mine area tributaries has occurred since 1980.

Pink salmon spawn in the study area from late July to early September (Fig. 4-9). Preferred spawning habitat is a gravel or gravel/cobble stream bed with depths of 12 to 46 cm (0.4 to 1.5 ft) and velocities from 0.30 to 0.60 m/s (1 to 1.9 ft/s) (ERT 1985c). Emergence reportedly occurs from mid-February into May (Fig. 4-9). Fry spend only a few days or weeks in their natal stream, moving rapidly out to the marine environment and feeding little in freshwater.

The fish resources of independent drainages that would be crossed by alternative transportation corridors have not been studied in great detail. However, ERT (1984b) reported spawning pink salmon in the lower mile of both Tyonek and Old Tyonek creeks in August 1984 and coho spawners in the upper reaches of each stream in October 1984. Threemile Creek has a run of several thousand red salmon and may also have some coho (Hepler 1985). Nikolai Creek has a run of perhaps several hundred chinook, as well as good runs of even-year pinks, a good resident rainbow population, and very likely some coho salmon (Hepler 1985).

4.4.4.3 Stream Habitat Evaluation

Physical and biological characteristics of the Chuitna River and its mine area tributaries have been described above in Sections 4.2, 4.3, 4.4.4.1, and 4.4.4.2. In addition to this information, a considerable body of data on specific characteristics of individual stream reaches that may be directly or indirectly impacted by the project was gathered in the baseline studies. These data (ERT 1984a, 1985c) are essential to the impact analyses described in Section 5.0 and provide necessary documentation for designing and measuring the success of stream reconstruction and rehabilitation. Parameters that are used in the impact analysis are summarized by stream reach in Table 4-13. Other physical and biological habitat data are available in the baseline studies reports (ERT 1984a,b) and the State Permit Application (ERT 1985c).

Maximum measured rearing densities and maximum spawner densities for each key species have been included (Table 4-13) for the various stream reaches that may be influenced by the project. Finally, each reach has been assigned a rating of habitat (resource) value based on a localized application of USFWS mitigation policy (FR Vol. 46, No. 15, 23 January, 1981). These assignments are based on perceived potential value of the various reaches (cf. entire drainage in standard USFWS applications), the physical and biological

Table 4-13

HABITAT AND BIOLOGICAL CHARACTERISTICS OF POTENTIALLY AFFECTED REACHES OF MINE AREA STREAMS (a)

DRAINAGE	20 CHUITNA R.	2002 LONE CR.	2002 LONE CR.	2002 LONE CR.	2003	2003	2003	2003	2003	2003	2004	2004	2004	2004
TRIBUTARY	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	200304	200305	200306	MAINSTEM	MAINSTEAM	MAINSTEM	200403
REACH	BELOW 2003	UPPER	MIDDLE	LOWER	UPPER	MIDDLE	LOWER	ENTIRE	ENTIRE	ENTIRE	UPPER	MIDDLE	LOWER	UPPER 360 m
REACH LENGTH (meters)	17910	3670	11360	6390	4610	8860	4020	2820	1650	2100	4630	4830	3020	360
MEAN WIDTH (meters)	22.6	2.4	3.7	6.7	1.8	8	4.6	1.2	1.2	2.4	2.4	3.3	3.9	1 (i)
REACH AREA (m2)	404766	8808	41950	42815	8298	35660	18492	3384	1740	5040	11112	15939	11778	360
POOL/RIFFLE (area ratio)	0.4-0.85	0.4-1.7	0.8-3.4	1.2-4.3	0.73-12.0	1.69-7.13	0.34-0.50	31.1	0.83-290	2.08-617	0.27-4.53	1.36-4.32	2.39	-
SLOPE (%)	0.5-3.0	1.0-3.0	1.0-1.5	1.0-1.5	0.5-3.0	0.5-2.5	1.5-3.5	3	1	1	2.0-5.0	0.5	2.5	-
SINUOSITY	HIGH	LOW	HIGH	MODERATE	LOW	HIGH	LOW	LOW	LOW	MODERATE	MODERATE-HIGH	HIGH	LOW	-
RIFFLE VEL. (major category, m/s, and percent)(b)	0.31-0.76 44	0.31-0.76 90	0.31-0.76 59	0.31-0.76 75	0.16-0.30 68	0.16-0.30 65	0.77-1.1 56	0.16-0.30 71	0.16-0.30 63	0.31-0.76 67	0.16-0.30 55	0.31-0.76 61	0.31-0.76 75	- -
BEAVER DAMS	NONE	FEW	MANY	FEW	NONE	MANY	FEW	FEW	NONE	MANY	FEW	FEW	MANY	-
DISCHARGE (annual range m3/s)	2.4-113+	0.01-2.9	0.08-17.2	0.23-19.4	<0.003-0.17	0.06-4.5	0.11-9.3	0.01-0.07	0.003-0.28	0.01-0.04	<0.006-0..'5	0.08-13.1	0.11-24	-
MAXIMUM MEASRED SPAWNING DENSITY (no./km)														
- CHINOOK	85	-	(j)	200	-	85(1)	85	-	-	-	45 (1)	45	-	-
- COHO	-	20	20-35	160	16-18	3-18	8	-	5	-	(j)	(j)	(j)	-
- PINK	1140	-	300(k)	190	150-250(k)	800-1000(k)	800-1000(k)	-	-	-	-	-	-	-
MAXIMUM MEASURED REARING DENSITY (no./m2)														
- CHINOOK	0.64 (d)	0.11	0.43	0.32	0	0	2.05	0	0	0.0 (e)	<0.04 (f)	<0.04 (f)	0.23 (f)	- (g)
- COHO	0.55 (d)	0.75	3.03	0.9	1.00	1.64	0.75	1.28	2.56	1.92 (e)	0.13 (h)	2.98 (h)	0.74 (h)	1.92 (e)
- RAINBOW/ DOLLY VARDEN	0.47 (d)	0.64	0.1	0.2	0.86	0.11	0.76	0.27	0.4	0.34 (e)	1.44 (h)	0.39 (h)	0.77(h)	0.34 (e)
ASSIGNED PROJECT AREA HABITAT VALUE														
- CHINOOK	VERY HIGH	MEDIUM	HIGH	VERY HIGH	LOW	HIGH	VERY HIGH	MEDIUM	MEDIUM	LOW	MEDIUM	HIGH	VERY HIGH	MEDIUM
- COHO	HIGH	HIGH	VERY HIGH	HIGH	HIGH	VERY HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	VERY HIGH	HIGH	HIGH
- PINK	HIGH	MEDIUM	HIGH	HIGH	HIGH	HIGH	HIGH	LOW	LOW	LOW	LOW	LOW	LOW	LOW
- RAINBOW/ DOLLY VARDEN	HIGH	HIGH	MEDIUM	MEDIUM	HIGH	MEDIUM	HIGH	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM	HIGH	MEDIUM

(a) Source: ERT (1984a, 1984b, 1985c) except as noted.
(b) Percent of total riffle area with velocities in major category.
(c) Actual density shown is highest documented in any baseline study year.
(d) Scaled from maximum density in lower 2003 and 2003 (averaged), based on ratios of 1982 minnow trap catch per unit of effort (CPUE); applicable to shorelines only.
(e) Based on average of 200304 and 200305 values.
(f) Scaled from lower 2003 density using ratios of 1982 minnow trap mean CPUE'S from applicable reaches.
(g) No basis for extrapolaton of density values.
(h) Scaled from highest 1983 or 1984 densities on 2002 and 2003 using 1982 minnow trap mean PLUE'S from comparable reaches.
(i) Estimated value.
(j) Species is present; no density estimate obtained.
(k) Source: Dames & Moore 1980.
(1) Lower portion only.

data available, and the assumption that access is unhindered to reaches currently blocked by beaver dams. This assumption is based on the trends observed between 1980 (Dames & Moore 1980) and 1984 (ERT 1985c) which indicate a progressive decline in numbers of chinook and pink spawners reaching upper stream areas. For example, the middle reach of the mainstem of Stream 2003 was rated as having high habitat value for chinook salmon despite the fact that none were taken in the 1983 or 1984 quantitative sampling in the reach. However, habitat present should be excellent for chinook juveniles if upstream access were not blocked by beaver dams and very likely would be used by adults for spawning as well.

Overall, the lower reaches of all three streams were rated as very high in habitat value for chinook while the middle reaches were rated very high for coho. Middle reaches were rated high for chinook based on their rearing potential but upper reaches and small tributaries tended to be rated low because low flow likely would limit access even in the absence of beaver dams. Most reaches in 2002 and 2003 were rated high for pinks based on the high densities of spawners seen in 1980 (Dames & Moore 1980), while 2004, where none have been seen, was rated low. All reaches were rated at least high for coho since only the uppermost reaches of the smaller tributaries lacked significant rearing by this species. Upper and lower reaches of the three streams were generally rated high for resident rainbow and Dolly Varden while middle reaches were of lesser value based on measured usage densities. The Chuitna River below 2003 was rated as very high in habitat value for chinook and high for all other species because of its combined function as a migratory pathway, spawning area, rearing area, and excellent sport fishing water.

4.5 MARINE ENVIRONMENT

4.5.1 Physical and Chemical Oceanography

Cook Inlet is a large tidal estuary with its axis trending NNE-SSW. It is divided into north and south sectors by the East and West Forelands. The Beluga region is in the north sector of Cook Inlet which has implications relative to circulation, water quality, and ice conditions.

4.5.1.1 Currents/Circulation

Tidal influences dominate currents and circulation patterns in Cook Inlet. Models of Cook Inlet tidal processes have been constructed (Carlson and Behlke 1972; Mungall and Matthews 1970) but do not offer sufficient resolution at the three possible port sites for impact assessment. Cook Inlet tides are mixed diurnal, exhibiting two unequal high and low tides in a period of about 25 hours; amplitudes range from 3 m (10 feet) at the mouth to 9 m (30 feet) at the head.

Tides were measured at the Granite Point port site for a few days during the feasibility investigations (Bechtel 1983; Nortec 1982) and these results indicate a tidal range on the order of 4 m (13 to 14 feet). Comparison of these data with predicted tides from other parts of Cook Inlet suggests some differences at the Diamond Alaska site relative to expected (adjusted predictions) tidal datum, levels and times. This affects site bathymetric survey data.

Currents, being tidally driven, reverse direction approximately every 6 hours. With the great tidal range, the velocities and turbulence of currents in Cook Inlet can be dramatic. The National Ocean Survey (NOS) conducted current monitoring in Cook Inlet during the mid-1970s. Their stations 55, 57, and 58 are in the Granite Point/North Foreland vicinity. Data from the NOS tidal current tables indicate higher flows approaching 5 knots. Because of the irregular seafloor and coastline, the ebb and flood current directions also vary from being exactly opposite in direction reversal; this is important in selecting dock location and orientation.

The highest currents measured at Granite Point during the brief feasibility investigation were on ebb, which peaked at 2.8 knots; flood tide reached 2.6 knots during this same short period. A statistical analysis (Nortec 1982) concluded that extreme tidal range at the site would be 5.8 m (17.8 feet) and extreme tidal current would be 6.2 knots. Net circulation direction across this site is probably to the southwest.

4.5.1.2 Bathymetry

Detailed bathymetric data are not available for the area between Trading Bay and the Beluga River except in the immediate vicinity of the proposed Granite Point and Ladd port sites (Nortec 1982). Navigation charts show that, in general, the sea bottom is gently sloping with a shallow shelf less than 18 m (60 ft) deep extending into Cook Inlet for a distance of 2100 m (7000 ft) to 3600 m (12,000 ft). The shelf narrows opposite the North Forelands where 18 m (60 ft) depths are found about 900 m (300 ft) from shore. The Granite Point bathymetric study indicated that many uncharted irregularities exist in the bottom topography. Shoals with water less than 18 m (60 ft) deep are present south of Granite Point and southeast of the mouth of Threemile Creek.

4.5.1.3 Wind and Wave Climate

Cook Inlet lies in a northwest-southeast storm track that is bounded on the northeast by the Canadian continental air mass and on the south and west by a maritime air mass. The location is susceptible to sudden intense storms. Prevailing winter winds are from the northeast and can reach intensities up to 66 knots. Because Cook Inlet is paralleled by mountain ranges, winds perpendicular to the channel seldom exceed 35 knots (Bechtel 1983).

There is little published data on waves in Cook Inlet. Carsola (1975) investigated waves in lower Cook Inlet and reported significant wave heights less than 0.6 m (2 feet) about 80 percent of the time. Maximum observed significant wave heights were reported at 2.4 m (8 feet) in that study. Most common wave periods are 3 to 4 seconds. The frequency of occurrence for deepwater waves greater than 2.6 m (8 ft) is about 12 percent, 5 percent for waves of 3.8 m (11.5 ft). Fishermen have reported observing waves in excess of 6.6 m (20 ft) during storms.

Tsunami waves are a possibility in Cook Inlet. Such waves were observed at Seldovia, and possibly at Homer, during the 1964 Alaska earthquake (Wilson and Torum 1968). The active volcanoes near Cook Inlet might also generate a tsunami wave. Mt. Augustine, an island in Cook Inlet south of the project area, erupted in 1976 and 1986.

4.5.1.4 Marine Water Quality

Cook Inlet water quality is incompletely understood and no studies have been done at this site. However, regional Cook Inlet studies and the dynamic mixing that is characteristic of Cook Inlet permit some generalizations for the site.

The water column is expected to be well-oxygenated. Suspended solids are very high in Cook Inlet, owing to the turbulent transport and the contribution of silt from glacier-fed runoff, which is especially high during spring/summer seasons (especially July, August, September). Rivers near the project area are important in this respect and include the Susitna, Beluga, and McArthur.

In upper Cook Inlet, the clay and silt particles are kept in suspension by the tidal currents. The circulation patterns in Cook Inlet result in much of this fine sediment being transported down the west side of the inlet, across the site (Gatto 1976). Surface suspended sediment near the site will be generally greater than 100 mg/l (Sharma et al. 1973).

Cook Inlet is a tidal estuary and its salinity may vary widely in areal distribution and by season. A mean salinity value at the site would be about 15 parts-per-thousand (Nortec 1982). During May through September, river discharges decrease the salinity of the upper inlet. Wintertime salinities rise due to greater dominance of the ocean water inputs from the south. The water on the west side of Cook Inlet tends to be fresher than on the east (Sharma et al. 1974; Burbank 1974).

Variations in surface salinities and temperatures are also a function of tide stage (Gatto 1976). The gradients will be stronger on the flood tide and less on the ebb, due to greater mixing.

The waters of western Cook Inlet are essentially unpolluted (except for natural sediment). Some local sources of pollution exist in the Anchorage and Kenai areas and in association with offshore drilling platforms. However, the flushing rate is so high that pollutants are quickly diluted.

4.5.1.5 Ice Conditions

Ice conditions are more extreme in the northern half of Cook Inlet than the southern. The ice derives from four sources: sea ice, beach ice, stamukhas*, and fresh water (river/esturary) ice. Ice floes commonly reach up to one mile across and 3-4 feet thick in Cook Inlet. Thicker ice also occurs from stamukhas and so tends to be softer. The greatest ice development is in December, January, and February. Ice floes tend to concentrate along the western shoreline during ebb tides, passing through the site vicinity.

Ice movement is primarily influenced by Cook Inlet circulation patterns, although this can be enhanced or retarded by winds. Cross-inlet ice movement due to wind forces is considered uncommon.

Local ice conditions may affect shipping and port design. There is some indication from satellite imagery that the Granite Point port site is somewhat protected from the dominant out-flowing ice due to the presence of Granite Point.

4.5.1.6 Other Marine Conditions

Corridors containing buried oil and gas pipelines extend eastward from Granite Point to offshore oil production platforms and across the inlet to Nikiski. Additional pipelines extend shoreward from oil platforms in Trading Bay. No anchoring is permitted near these corridors.

Cook Inlet is used year-round for shipping, with regular winter traffic to the Port of Anchorage. Offshore oil platforms are common in the site's operating vicinity.

Fishing vessels operate throughout Cook Inlet during the open-water seasons.

4.5.2 Biology

4.5.2.1 Lower Trophic Levels

The estuarine habitat of upper Cook Inlet is characterized by high turbidity and suspended sediment levels, extreme tides and currents, highly variable salinity, and seasonal ice formation (Section 4.5.1). This combination has discouraged biological research and has lead to the widely held conviction that, except for seasonal passage of anadromous fish such as Pacific salmon and eulachon (*Thaleichthys pacificus*), and the belukha whales (*Delphinapteras leucas*) which feed upon them, the upper Inlet is a very unproductive environment (Bakus et al. 1979). Bakus et al. (1979) looked at some portions of the biological community in the vicinity of the Anchorage airport and concluded that subtidal infauna was essentially nonexistent and that intertidal life was very poor. The diversity and abundance of plankton also was less than that observed at other locations. Macroscopic algae on the beaches in the Granite Point/Trading Bay area are reportedly limited to mats of the green alga *Vaucheria* sp., while three additional species have been reported elsewhere in the upper Inlet. In contrast, in an intensive study of Knik Arm, Dames & Moore (1983) found evidence of an active ecosystem despite these conditions and despite the apparent low primary productivity. They found that massive quantities of organic detritus are carried to the Inlet by its many tributary rivers and that an abundance of a limited number of species of large epibenthic invertebrates that are likely detritivores* (mysids, crangonid shrimp, amphipods) are found in the Inlet. Limited sampling in the vicinity of Granite Point indicate that a similar invertebrate assemblage is present at the locations of the two port site alternatives (ERT 1984a). Infauna* at the port site is very likely limited to a small bivalve (*Macoma balthica*) and unidentified polychaetes (DOWL 1981).

4.5.2.2 Fish

In addition to serving as a transport pathway bringing large quantities of organic detritus to the highly productive waters of lower Cook Inlet, the upper Inlet is also a migratory pathway for anadromous fish including all five eastern-Pacific species of salmon as well as eulachon, smelts (Osmeridae) and Bering cisco (*Coregonus laurettae*). A number of species of marine fish have been taken in upper Cook Inlet (Table 4-14) although their significance does not compare with that in the lower Inlet (Blackburn 1978). Limited late-summer beach seine sampling in the North Foreland area captured 10 species of fish, including pink, chum, and coho salmon as well as Dolly Varden (age unspecified, ERT 1984a). A more intensive spring sampling regime in Knik Arm (Dames & Moore 1983) collected 18 species including five not previously reported from the upper Inlet which must be

Table 4-14

FISH SPECIES KNOWN TO OCCUR IN UPPER COOK INLET

Scientific Name	Common Name	Spawning Period[1]	Time Spent in Marine Environment
Fish			
Salmonidae	Trout, salmon, white fish		
Oncorhynchus gorbuscha	Pink (humpback) salmon	mid-July - early Sept.	1+ year
O. keta	Chum (dog) salmon	early Aug. - early Oct.	2 - 4 years
O. kisutch	Coho (silver) salmon	early Aug. - Feb.	1 -3 year
O. nerka	Sockeye (red) salmon	early Aug. - Nov.	1 - 4 years
O. tshawytscha	Chinook (king) salmon	mid- June - mid-Aug.	1 - 6 years
Salmo gairdneri	Steelhead (rainbow) trout[2]	fall - spring	2 mo. - 4 years
Salvelinus malma	Dolly Varden	fall	several weeks to 6-7 months
Coregonus laurettae	Bering cisco	fall(?)	2 - 3 months per year
Osmeridae	Smelts		
Hypomesus pretiosus	Surf smelt	March to May	entire life cycle
Sperinchus thaleichthys	Longfin smelt	Oct. to Dec.	1 - 2 years
Thaleichthys pacificus	Eulachon	mid- to late May	entire life cycle except about 2 weeks
Clupeidae			
Clupea harengus pallasi	Pacific herring	spring	entire life cycle
Gadidae	Codfishes		
Gadus macrocephalus	Pacific cod	usually Jan. & Feb.	entire life cycle
Theragra chalcogramma	Walleye pollock	winter	entire life cycle
Elginus gracilis	Saffron cod		entire life cycle
Gasterosteidae	Sticklebacks		
Gasterosteus aculeatus	Threespine stickleback	June to July	variable, but anadromous forms spend up to 1 year in fresh water before moving to sea
Pungitius pungitius	Ninespine stickleback	May to July	variable, always spawn in fresh water
Liparidae	Snailfish		
Liparis rutteri	Ringtail snailfish		entire life cycle
Cottidae	Sculpins		
Leptocottus armatus	Pacific staghorn sculpin	Oct. to March	entire life cycle
Pleuronectidae	Flounders		
Platichthys stellatus	Starry flounder	March to April	entire life cycle
Hippoglossoides elassodon	Flathead sole	March to late April	entire life cycle
Hippoglossus stenolepis	Pacific halibut	winter	entire life cycle
Limanda aspera	Yellowfin sole		entire life cycle

Sources: ERT 1984a, Dames & Moore 1983, Scott and Crossman 1973.

[1] No anadromous rainbows are known from rivers north of east and west forelands; however, Dames & Moore (1983) captured a single sexually mature rainbow (195 mm [7.7 in]) in uper Cook Inlet in May 1983.

assumed to also occur seasonally in the study area (Table 4-14). More importantly, the Knik Arm study proved that fish do more than just migrate through the upper Inlet; many, including juvenile salmon, feed on the abundant epifauna in the area, while others, such as smelt and Pacific herring (Clupea harengus) may spawn on the beaches of the upper Inlet.

Use of the study area beaches and nearshore waters for these functions is unknown; however, given the considerable human activity in the area, significant beach spawning would not likely have gone unnoticed. Beaches in the study area do not appear unique in any way and the Knik Arm study did not detect any particlar preferences of fish for specific beach types. Certainly, there is considerable feeding by juvenile anadromous fish in the area, particularly on the broad flats and tidal channels of Trading Bay and around the mouth of the Chuitna River. Adult salmon returning along the shoreline to their natal streams probably do not feed extensively in the upper Inlet. For them, the study area shoreline likely is an extremely important migratory pathway providing access to the numerous rivers to the north. Commercial fisheries in the area are discussed in Section 4.5.3.

4.5.2.3 Birds and Mammals

Most beaches, mud flats, and nearshore waters of upper Cook Inlet are not heavily utilized by waterfowl and marine birds (Dames & Moore 1983). Small numbers of gulls (Laridae) and sea ducks rest on the water surface but foraging opportunities are limited by the high turbidity. Scarcity of infauna likewise may discourage use by shorebirds, except in small bays and at the mouth of creeks and rivers. An exception to this generally low use by birds occurs in the large saltmarsh and mud flat areas of Trading Bay to the south and the Susitna Flats to the north, as well as the much smaller flats around the mouth of the Chuitna River and between Granite Point and Nikolai Creek. These areas are very important spring and fall staging areas for a number of waterfowl and shorebird species and are important sport hunting areas as well (see Section 4.10.2). In addition, a small (estimated 30 nesting pairs) colony of glaucous-winged gulls is located about 0.8 km (0.5 mi) north of the proposed Ladd port site (ERT 1986).

Only two of the 21 species of marine mammals reported from lower Cook Inlet are common in the upper Inlet; these are belukha (beluga) whale (Delphinapterus leucas) and harbor seal (Phoca vitulina) (Calkins 1981). In the study area, both species are common primarily in the spring and summer when they feed on anadromous fish near the mouths of rivers. The area from Trading Bay to the Susitna River appears to be especially important for belukhas with numerous sightings near the mouth of the Beluga River during

July of 1982 and 1983 by baseline study team members (ERT 1984a). The area between the Beluga and Susitna rivers may also be a significant calving and/or nursery area for belukhas (Calkins 1981).

Information on the life history of harbor seals in upper Cook Inlet is incomplete; however, they are common at times in certain areas (ERT 1984a). Harbor seals are present from May to September. During the winter months, they most likely move to Lower Cook Inlet. Like the belukha, they appear to feed on anadromous fish, following them to, and into, the mouths of the Inlet's tributary rivers.

4.5.2.4 Threatened or Endangered Species

None of the marine biota known to frequent the study area are considered endangered or threatened.

4.5.3 Commercial Fisheries

The only significant commercial fishery in upper Cook Inlet is that for the five species of Pacific salmon. Above the East and West Forelands, all commercial fishing is by set net (fixed gill net). Tyonek residents held 26 set net permits in 1983. The area from Chuit flats to Threemile Creek is fished intensively; set net sites are nearly continuous. Commercial fishing is somewhat less intensive from Chuit Flats to Granite Point. Permits in this area are held almost exclusively by Tyonek residents. From Granite Point west to within 1.6 km (1 mi) of Nikolai Creek, there are some 14 permits held and fished by local residents or lease holders (individuals leasing fishing camp sites).

The combined total catch of all species of salmon in ADF&G statistical areas 247-10 (West Foreland to Granite Point) and 247-20 (Granite Point to Threemile Creek) have averaged 4 percent of the total upper Inlet catch over the last 19 years (Table 4-15). While numbers of fish taken in these two reporting subareas have increased in the last 5 years, the percentage contribution to the total upper Inlet fishery has declined to 2.9 percent (based on 1980-1984 averages; Table 4-15), probably due to increased effort in other portions of the upper Inlet. The two commercial fishery subareas on either side of Granite Point contribute the highest percentage of pink and coho salmon (6 and 7.3 percent, respectively, using 1980-1984 averages) and the lowest percentage of chum and sockeye (0.7 percent each using 1980-1984 averages). This harvest distribution coincides to a degree with the relative importance of these species in the Chuitna River, although what proportion of the catch is actually contributed by the Chuitna System has not been determined.

Table 4-15

UPPER COOK INLET SALMON CATCH SUMMARY 1966-1984

	CHINOOK				SOCKEYE				COHO				EVEN YEAR PINK			
	1966-84		1980-84		1966-84		1980-84		1966-84		1980-84		1966-84		1980-84	
LOCATION[1]	AVE	%[2]	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%
UPPER COOK INLET (No. of Anchor Pt.)	11956.9	100.0	15262.0	100.0	1569808.0	100.0	2658000.0	100.0	285337.0	100.0	501881.0.	100.0	1236872.0	100.0	1066529.0	100.0
NORTHERN DISTRICT (No. of Forelands)	1583.0	13.2	1250.0	8.2	105224.0	6.7	173707.0	6.5	61154.0	21.4	94799.0	18.9	234180.0	18.9	217245.0	20.4
GENERAL SUBDISTRICT (West side of Inlet)	1006.0	8.4	1001.0	6.6	61218.0	3.9	105884.0	4.0	50025.0	17.5	77890.0	15.5	209963.0	17.0	198198.0	18.6
AREA 247-10 (W. Foreland Granite Pt.)	425.0	3.6	317.0	2.1	11463.0	0.7	15874.0	0.6	14184.0	5.0	18231.0	3.6	56940.0	4.6	43375.0	4.1
AREA 247-20 (Granite Pt. to Threemile Creek)	222.0	1.9	183.0	1.2	13421.0	0.9	21785.0	0.8	12910.0	4.5	18753.0	3.7	46584.0	3.8	33032.0	3.1

	ODD YEAR PINK				CHUM				ALL SPECIES			
	1966-84		1980-84		1966-84		1980-84		1966-84		1980-84	
LOCATION[1]	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%
UPPER COOK INLET (No. of Anchor Pt.)	176448.0	100.0	98748.0	100.0	703945.0	100.0	891441.0	100.0	3305607.0	100.0	4773000.0	100.0
NORTHERN DISTRICT (No. of Forelands)	52283.0	29.6	37465.0	37.9	31522.0	4.5	42222.0	4.7	347500.0	10.5	457291.0	9.6
GENERAL SUBDISTRICT (West side of Inlet)	46671.0	26.5	33350.0	33.8	28853.0	4.1	36284.0	4.1	273717.0	8.3	353317.0	7.4
AREA 247-10 (W. Foreland Granite Pt.)	11458.0	6.5	4960.0	5.0	4323.0	0.6	4140.0	0.5	65791.0	2.0	66671.0	1.4
AREA 247-20 (Granite Pt. to Threemile Creek)	13818.0	7.8	11725.0	11.9	8533.0	1.2	8262.0	0.9	66150.0	2.0	73492.0	1.5

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[1] Data from K. Tarbox, ADF&G Commerical Fish Division, Soldotna; 1984 data are preliminary; Upper Inlet includes all gear types; other subareas are only fished by set net.

[2] All percents are given as a percentage of the total upper Inlet harvest.

4.6 METEOROLOGY, AIR QUALITY, AND NOISE

4.6.1 Meteorology

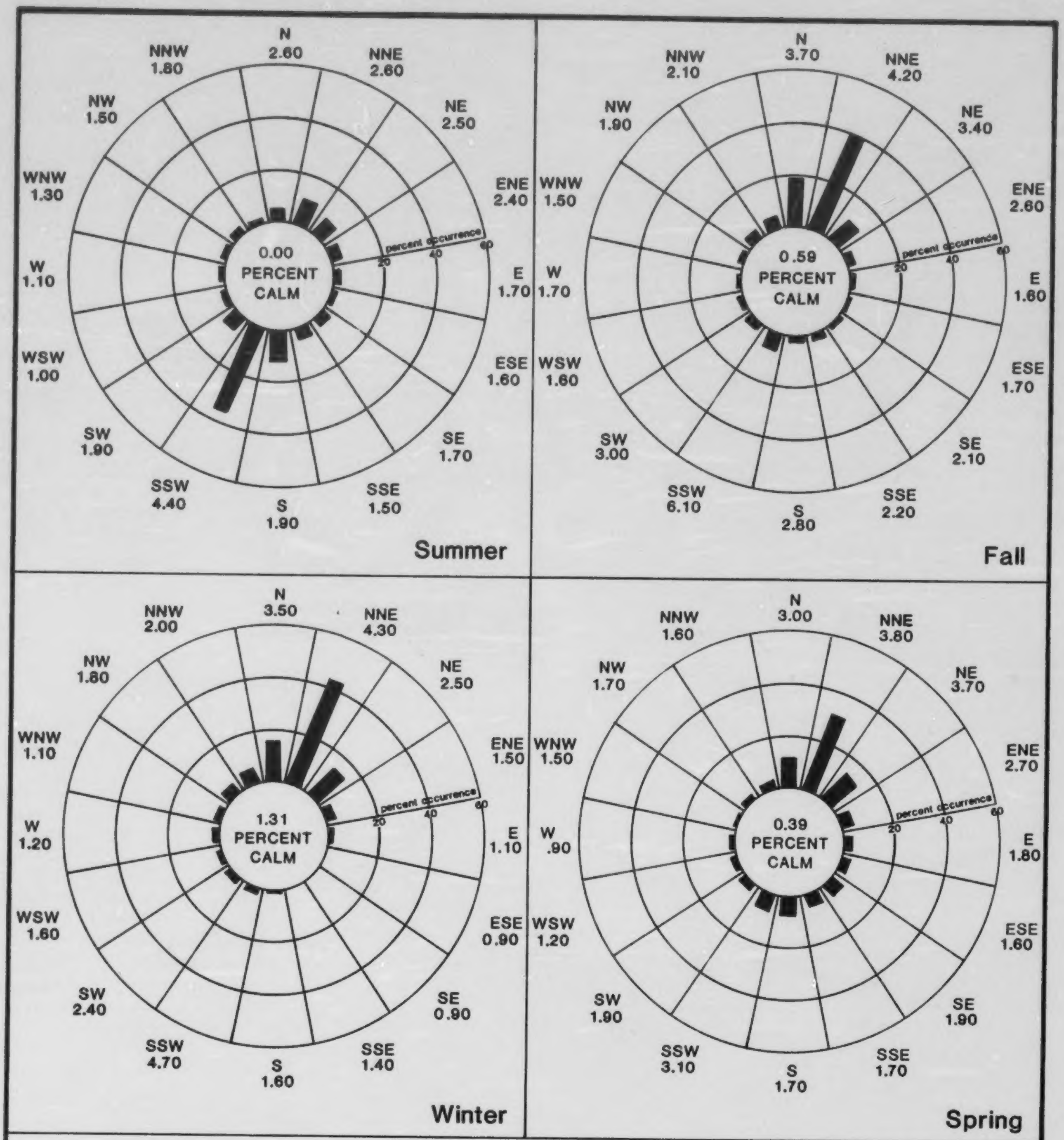
The regional climate near the project site is most noticeably influenced by regional topography and bodies of water. The Chugach Mountains to the south act as a barrier to warm, moist air from the Gulf of Alaska, decreasing local precipitation to less than 20 percent of that measured on the Gulf of Alaska side of the Chugach Range. The Alaska Range to the west and north acts as a barrier to very cold winter air masses which dominate the Alaska interior. Cook Inlet tends to moderate temperatures in the project area.

A one-year meteorological monitoring program was conducted at the project site from April 1983 through March 1984 (Science Applications, Inc. 1984). Two monitoring sites were installed: one near the proposed surface coal mine and a second near the proposed Granite Point port facilities. Wind speed, wind direction, and temperature were measured at 12 meters (39.4 ft) above ground level at both sites.

Seasonal wind roses for the two sites, given in Figures 4-10 and 4-11, show a predominant southerly flow during the summer months and a predominant northerly flow during the rest of the year. At Granite Point, north and northeast wind directions occur most frequently during the fall, winter, and spring seasons while the most frequent wind directions during the summer are south-southwest and south with a secondary maximum at north-northeast. At the coal mine site, the predominant wind directions measured were north-northwest and north during the fall and winter, north-northwest through north-northeast with a small secondary maximum at south-southeast during the spring, and south through southwest with a large secondary maximum about north during the summer. Wind speeds at both sites were relatively light, averaging 3.1 m/sec (6.9 mph) and 2.4 m/sec (5.4 mph) for the monitored year at the port and coal mine sites, respectively.

The climates of Anchorage and Kenai are similar to that of the project area due to the influence of the Chugach and Alaska mountain ranges and Cook Inlet. Seasonal wind roses for Anchorage (Figure 4-12) show a northerly flow during fall and winter and a southerly flow in spring and summer. North to northeast winds occur during the fall and winter months, while south to southeast winds dominate during the spring and summer months. Wind speeds at Anchorage are comparable to those of the project area, averaging 3.3 m/sec (7.3 mph).

Wind roses for Kenai (Figure 4-13) also show a strong northerly flow during fall and winter and a more subtle southerly flow in spring and summer. North to north-



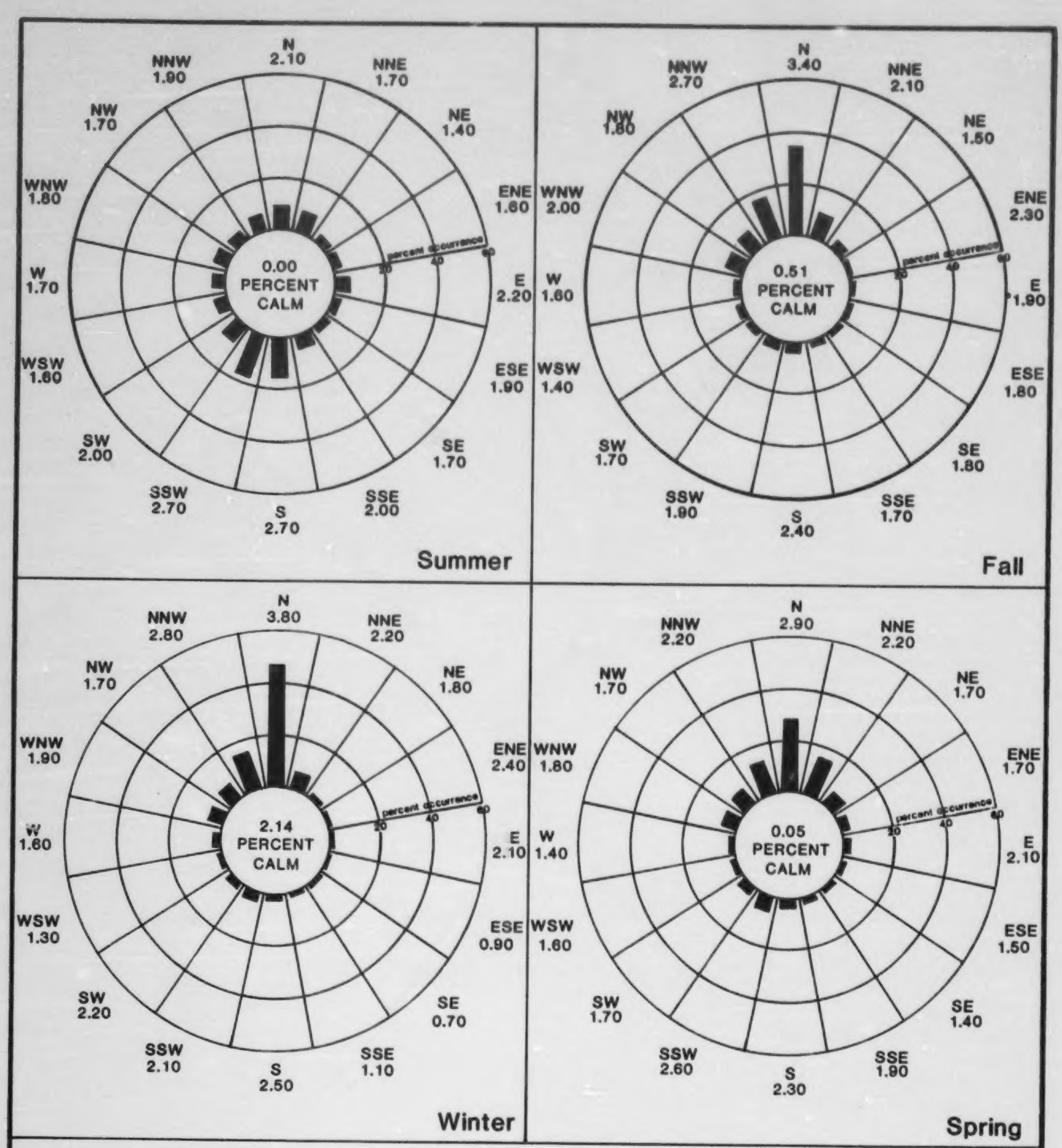
NUMBERS INDICATE SECTOR MEAN WIND SPEED (METERS/SEC.)

SOURCE: SCIENCE APPLICATIONS INC., 1984

WIND FREQUENCY DISTRIBUTION
GRANITE POINT PORT SITE

Diamond Chuitna Environmental Impact Statement

FIGURE 4-10



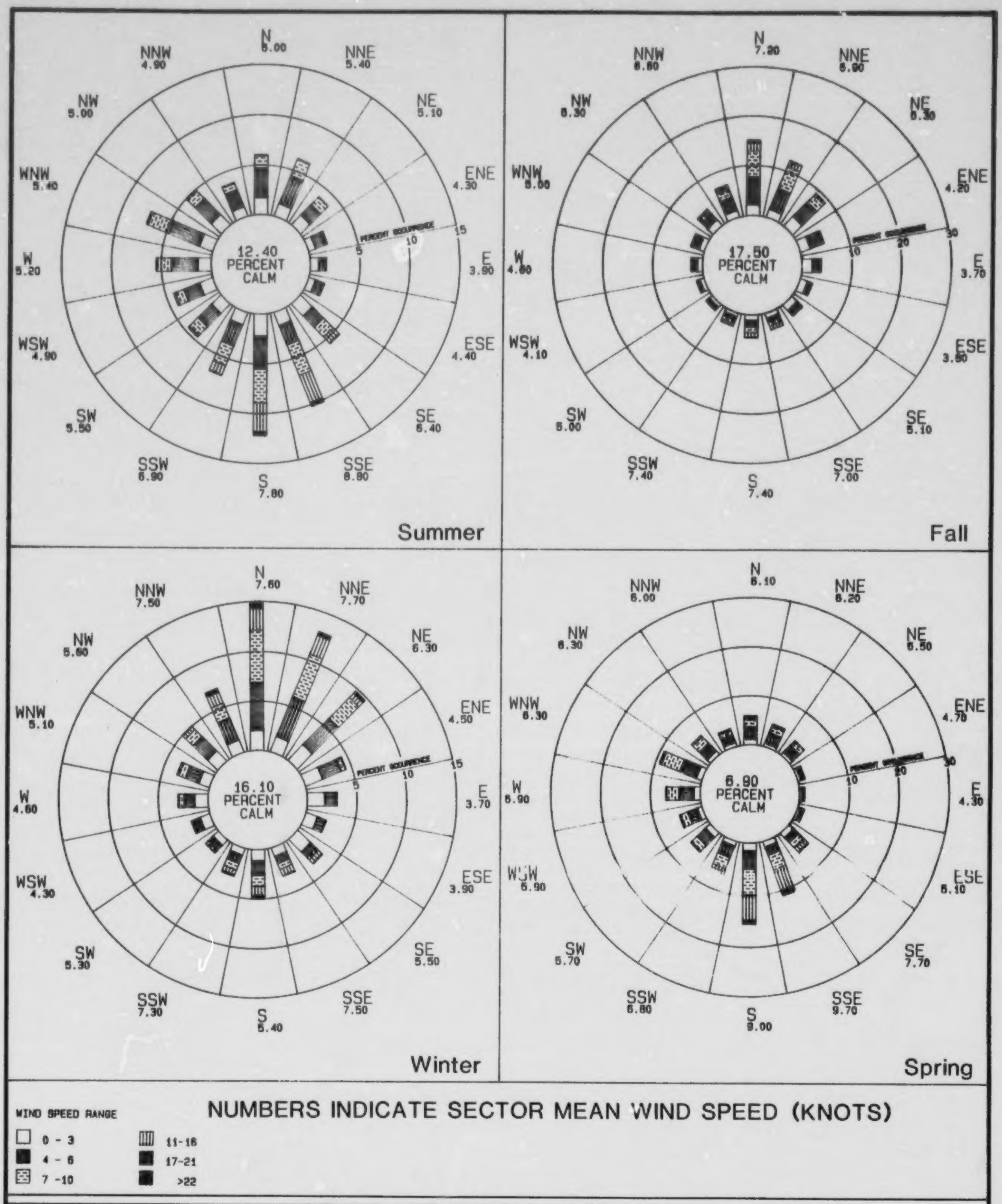
NUMBERS INDICATE SECTOR MEAN WIND SPEED (METERS/SEC.)

SOURCE: SCIENCE APPLICATIONS INC., 1984

WIND FREQUENCY DISTRIBUTION
MINE SITE

Diamond Chuitna Environmental Impact Statement

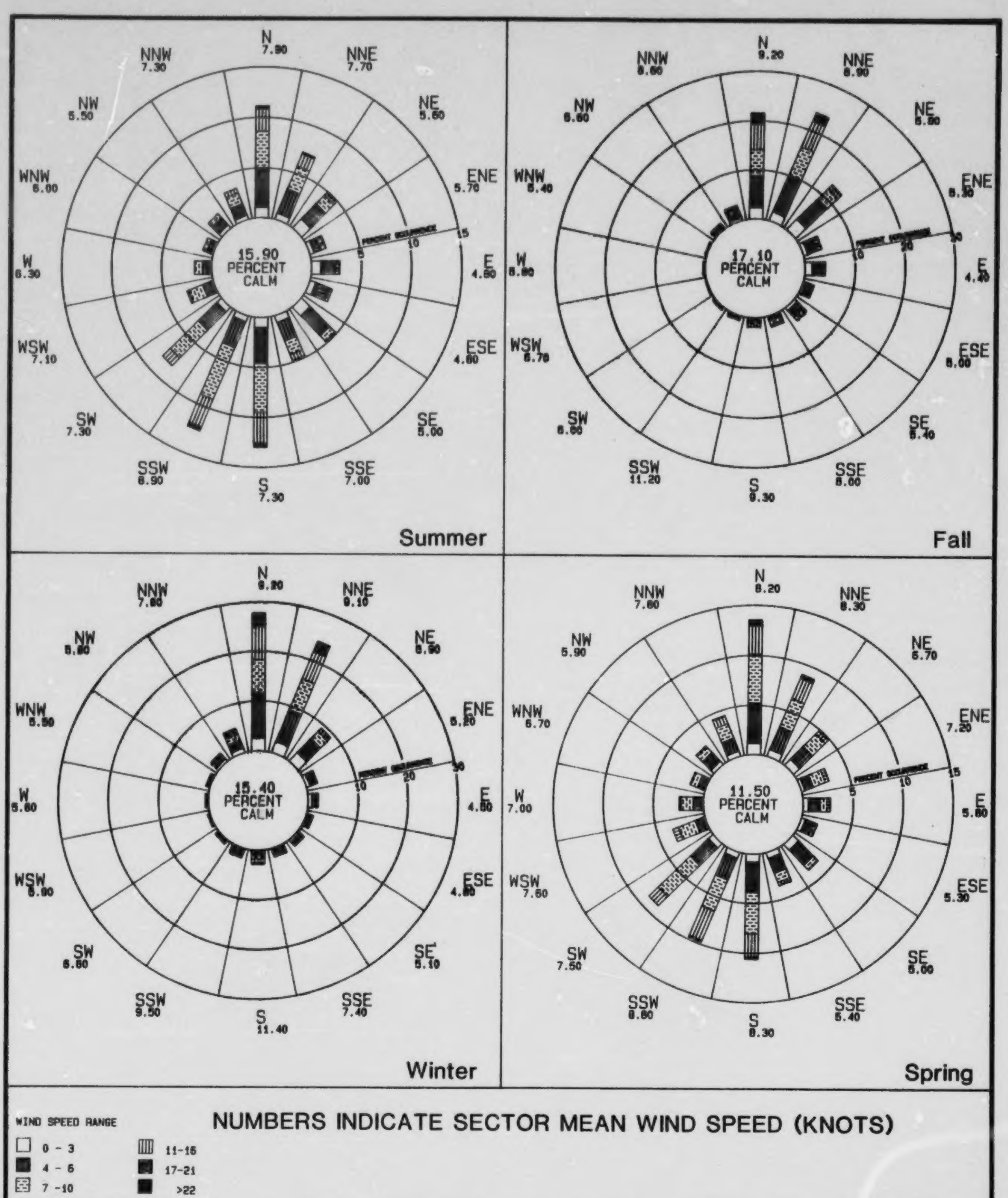
FIGURE 4-11



WIND FREQUENCY DISTRIBUTION
ANCHORAGE

Diamond Chuitna Environmental Impact Statement

FIGURE 4-12



NUMBERS INDICATE SECTOR MEAN WIND SPEED (KNOTS)

WIND FREQUENCY DISTRIBUTION
KENAI

Diamond Chuitna Environmental Impact Statement

FIGURE 4-13

northeast winds are dominant during the fall and winter months, while south to southwest winds are frequent in spring and summer. Wind speeds at Kenai are similar to those at the project sites and Anchorage, averaging 3.4 m/sec (7.5 mph).

Monthly temperatures measured at the project monitoring sites are given in Table 4-16. Temperatures measured at the port site were slightly warmer than the mine site, particularly during the winter, with the mine site exhibiting slightly higher maximum daily temperatures in the summer. This pattern is typical for a shoreline environment and demonstrates the moderating effect of Cook Inlet on ambient temperatures. Maximum and minimum temperatures measured at either site were 22°C (71°F) and -22°C (-7°F), respectively. Temperature and precipitation summaries from a one-year monitoring program near Kenai (June 1981 through May 1982) are also given in Table 4-16. No site-specific precipitation data were measured at either project monitoring site. Average yearly precipitation in the Chuitna Basin is approximately 122 cm (48 inches), which is considerably greater than the 39 cm (15.4 inches) measured near Kenai. This difference is due to orographic* effects reflecting the higher elevations in the Chuitna Basin area. In 1983, snow depths in the area varied from 58 cm (23 in) near Congahbuna Lake to 229 cm (90 in) on Capps Plateau.

4.6.2 Air Quality

Air quality data for the project site area were available from the following programs:

- Monitoring site operated for Tesoro Petroleum near Kenai during June 1981 through May 1982 (All major criteria pollutants were measured except lead)
- ADEC Total Suspended Particulate monitor located on the Beluga Power station during April 1978 through May 1979
- ADEC SO_2 monitoring site located near Kenai at Wik Lake for November 1982 through May 1983.

Maximum measured concentrations from the Tesoro and Beluga monitoring sites are compared to ambient air quality standards in Table 4-17. These data indicate that measured ambient background levels of all major pollutants were significantly less than applicable standards. Sulphur dioxide (SO_2) data measured at the Wik Lake monitor during the available data period were nearly always 0 ppb (1-hour measurement) with an occasional 5 ppb reading which may have been due to instrument zero drift.

Since the project site is considerably more remote than the Tesoro monitoring site, air quality is expected to be better than that presented in Table 4-17.

Table 4-16

MONTHLY TEMPERATURE (°C) AND PRECIPITATION (cm) SUMMARY FOR PROJECT REGION

Month	Monthly Average Temperature			Average Daily Max. Temperature		Average Daily Min. Temperature		Monthly[1] Precipitation
	Port	Mine	Kenai	Port	Mine	Port	Mine	Kenai
JAN	-4	-5	-12	-2	-3	-7	-8	0.
FEB	-5	-6	-8	-2	-3	-7	-8	2.
MAR	3	2	-3	5	4	1	0	2.
APR	3	2	0	5	4	1	0	0.
MAY	8	7	5	11	10	5	4	1.
JUN	12	12	10	15	15	9	8	2.
JUL	13	13	12	15	16	11	9	5.
AUG	13	12	11	15	15	10	9	4.
SEP	8	6	9	11	9	5	3	6.
OCT	3	0	3	5	3	0	-1	12.
NOV	1	0	-4	2	2	-1	-1	4.
DEC	-4	-4	-8	-1	-2	-6	-5	1.
YEAR	4	3	1	7	6	2	1	39.

[1] given as liquid water equivalent

Source: Science Applications, Inc. 1984; Radian Corp. 1982

Table 4-17

REGIONAL MEASURED AIR QUALITY DATA

(micrograms/cubic meter)

Site/Pollutant	1-hour	3-hour	8-hour	24-hour	Annual
FEDERAL AND ALASKA AIR QUALITY STANDARDS					
NO_2	-[a]	-	-	-	100
SO_2	-	1300	-	365	80
CO	40000	-	10000	-	-
O_3	235	-	-	-	-
PM	-	-	-	150	60
TESORO PETROLEUM					
NO_2	-	-	-	-	6.3
SO_2	-	70	-	9	0.3
CO	2560	-	1660	-	-
O_3	96	-	-	-	-
PM	-	-	-	60	9
BELUGA					
PM	-	-	-	78	-[b]

[a] indicates that an air quality standard does not exist for this pollutant and averaging time; hence, no measured air quality data will be presented.

[b] No annual average PM concentration was calculated for Beluga due to the large amount of missing data.

Source: Chapple 1985; Radian Corp. 1982

4.6.3 Sound Climate

The project area in the vicinity of the proposed mine and transportation corridor is expected to experience sound levels typical of remote locations unaffected by human activities. Typical natural sound levels are approximately 45 db(A) with higher levels of natural sound of about 65 db(A) associated with storms and wildlife. Sources of natural noise include winds, rain, and wildlife vocalizations.

The project area in the vicinity of the Cook Inlet coast experiences higher background noise levels. Cook Inlet contributes higher noise levels because of breaking waves and winter ice movements. Human activities are also more frequent near the coast. Some examples of human-generated noise include vessels (such as diesel-powered boats on Cook Inlet), aircraft (a landing strip is located approximately 2 miles from the proposed Granite Point port site), and other mobile vehicles such as snowmobiles and all-terrain vehicles. Typical noise levels for vehicles and aircraft are 80 to 95 db(A) at a distance of 50 feet. Commercial and noncommercial aircraft on route from Anchorage to southwestern Alaska locations fly over the project area routinely at varying altitudes.

4.7 SOCIOECONOMIC ASPECTS

The project site is located about 75 air miles west of Anchorage in the Kenai Peninsula Borough and about ten miles west of the Native village of Tyonek. Socioeconomic impacts would likely derive from increased income and employment of residents of both Anchorage and the Kenai Peninsula Borough, particularly the City of Kenai and the Village of Tyonek. The City of Kenai is the Borough seat of government and its most populous city; Tyonek is the nearest community to the project site. The following description of the socioeconomic environment focuses on conditions in the Kenai Peninsula Borough, the Municipality of Anchorage, and the community of Tyonek.

4.7.1 Anchorage and Kenai Peninsula

4.7.1.1 Population

The population of Anchorage and the Kenai Peninsula Borough grew rapidly between 1970 and 1984, exceeding the substantial statewide growth of 77.8 percent. Anchorage grew from 126,385 persons in 1970 to 244,030 in 1984-an increase of 93.1 percent. The Kenai Peninsula Borough population increased by 134.6 percent from 16,586 in 1970 to 38,919 by 1982 (Alaska Department of Labor 1984). The City of Kenai grew by 42.8 percent over this period, from 4,324 to 6,176 persons. The Central Kenai Peninsula, which includes the area within primary commuting distance of the

City of Kenai, had a 1984 population of 24,643. Historical population trends are summarized in Table 4-18.

The State of Alaska currently has no official population projections for either the Kenai Peninsula Borough or Anchorage (Williams 1985). Population forecasts used here assume a slowdown of growth for the Kenai Peninsula Borough from 11.1 percent annually over the 1980-84 period to 5 percent per year through 1992. Thus, by 1992 the population of the Kenai Peninsula Borough is expected to be approximately 57,500. The 1992 populations of the City of Kenai and the Central Kenai Peninsula are projected to be 9,100 and 36,400 respectively, based on a 5 percent average annual increase. Preliminary draft population projections for Anchorage indicate a high projection of 314,800 by 1990, a low projection of 273,100, and a medium or most likely population of 292,300 (Breedlove 1985).

4.7.1.2 Economy

The following discussions of the economies of the Kenai Peninsula Borough and Anchorage focus on the cash economy. Subsistence activities, which provide food and sustenance for many residents of the Kenai Peninsula Borough, are not reflected in the statistical data presented. Therefore, comparisons of data for Anchorage, in which relatively little subsistence activity occurs, to data for the Kenai Peninsula Borough, where substantial subsistence activities are conducted, must be made carefully. A discussion of subsistence activities of the Tyoneks is presented in Section 4.9.

The economies of the Kenai Peninsula Borough and Anchorage are distinctly different. While employment in Anchorage is relatively concentrated in trade, service, and federal government, employment in the Kenai Peninsula Borough is based primarily on resource development industries and state and local government.

Over time, employment patterns in the Kenai Peninsula Borough indicate a proportional drop (but a small numerical increase) in mining employment (the standard industrial code of mining includes oil and gas extraction). The loss of federal government jobs since 1970 has been counteracted by increases in state and local government, employment, manufacturing (including petrochemical industry), and the service sector (trade, services, and finance, insurance, and real estate). The sectors that bring new income into the region (the "basic" or "export" sectors) are primarily federal government, mining, and manufacturing. Tourism is also an important basic sector, but existing data do not isolate tourist-serving employment and therefore the employment involved is not readily quantifiable.

The Anchorage economy has diversified since 1970 and has become more service-oriented. Dependence on federal

Table 4-18

POPULATION TRENDS IN ALASKA, ANCHORAGE, AND THE KENAI PENINSULA BOROUGH

	Population			
Jurisdiction	1970(a)	1980(a)	1982	1984
Alaska Statewide	302,583	401,851	460,837(b)	538,000(c)
Anchorage	126,333	174,431	204,216(c)	244,030(c)
Kenai Pen. Borough	16,586	25,282	5,231(d)	6,176(d)
-Central Kenai Pen. Bor.	na	15,672(e)	19,886(f)	24,643(f)

(a) Source: U.S. Department of Commerce, Census counts for years indicated.

(b) Source: Alaska Department of Labor 1984.

(c) Source: Van Patten 1985.

(d) Source: Kenai Peninsula Borough 1984.

(e) Source: Unavailable from census in geographically-consistent form. Figure is cited from 1978 special census conducted by Kenai Peninsula Borough which resulted in total Borough population estimate very close to the 1980 census estimate, considered by local planners to be a substantial undercount (McIlhargy 1985).

(f) Source: McIlhargy 1985.

government employment has declined and the proportion of employment in all other economic sectors has increased.

Unemployment rates in the Kenai Peninsula Borough have historically been substantially higher than those in Anchorage, as well as more subject to seasonal swings. Over recent years, the average annual unemployment rate in the Kenai Peninsula Borough has ranged from a high of 15.9 percent in 1982 to a low of 10.1 percent in 1977. The monthly unemployment rate, however, has been nearly 22 percent during winter months. Unemployment in Anchorage has remained within a narrow 7 to 8 percent range and exhibits relatively modest seasonal changes.

Unemployed workers in the Kenai Division tend to have previous experience in the oil and gas and construction industries, compared to the statewide average. Of the 2,165 unemployment claims filed with the Kenai office of the Alaska Department of Employment Security in 1982, 16.6 percent, or about 360, listed oil and gas as the last industry of employment and 24.8 percent, or about 540, listed construction. The corresponding Anchorage local office figures indicate that 22 percent of the unemployment insurance applications listed construction as last industry of employment. Oil and gas was listed by 6.4 percent. In terms of skills, structural work was the occupation listed by most applicants in either office (40.9 percent for Kenai and 28.7 percent for Anchorage) (Alaska Department of Labor 1984). It should be noted that there are probably fewer individuals represented by the above data which was taken from the number of applications, since some applicants probably applied twice or more during the course of the year. However, since only the last industry of employment and occupation are listed on unemployment insurance applications, the figures above probably understate the actual experience of applicants over their careers.

The Borough-wide employment-to-population ratio was 36 percent in 1984. Since labor force participation rates will likely continue to increase, a projected employment-to-population ratio of 40 percent is used herein. The area included within the primary Kenai commuting area is the Central Kenai Peninsula (CKP), consisting of Sterling, Soldotna, Ridgeway, Kalifonski, Kenai, Salamatof, Nikiski, and Tustumena. This area had a population of 24,643 in 1984 and is projected to grow by 5 percent annually without the project, to 30,000 by 1988 and 36,400 by 1992. If 40 percent of the population is employed, the number of employed residents of the CKP would be about 12,000 in 1988 and 14,600 by 1992. If the assumed annual Borough-wide population growth rate of 5 percent (Section 4.7.1.1) applies to the City of Kenai's employment base, about 3,000 of its residents would be employed by 1988 and about 3,700 by 1992.

Per capita personal income in the Kenai-Cook Inlet Division was $13,394 in 1982. This was somewhat below the statewide average of $16,598 and the Anchorage Division figure of $18,429 (U.S. Department of Commerce 1984a). Cost-of-living differentials between these three areas, however, prevent accurate comparison in terms of real income.

4.7.1.3 Community Facilities and Services

As Alaska's primary urban area, Anchorage is in general well-served by all facilities and services necessary for urban life, making detailed discussion unnecessary. For a smaller community, the City of Kenai is also generally well-served by sewer, water, and road systems and public services such as fire and police protection and education.

Public Services and Facilities in Kenai

Kenai's water system services much of the city, with about 1,100 residential connections (compared to an estimated 2,446 housing units in 1984 [Kenai Peninsula Borough 1984]) serving 3,500 people and under 100 commercial connections. The City's water source is the aquifer at Beaver Creek, which is of excellent quality and requires only chlorination at the wellhead. The combined design capacity of the City's two water pump stations is about 2,000 gallons per minute, or about 2.9 million gallons per day (gpd). Daily water demand averages slightly less than 500,000 gpd, with a peak of about 1,200,000 gpd (Lashot 1985).

Kenai's sewer system also services much of the City, with about 1,100 of the City's homes currently connected. The total volume of effluent treated averages 800,000 gpd. With a design capacity of 1,300,000 gpd, the system is expected to be adequate to service the City's needs through the early 1990s. Solid waste is disposed of at a landfill operated by the Kenai Peninsula Borough (Bambard 1985).

The City Airport is serviced by three commuter airlines as well as several private charter services. The airport has a 7,575 ft (2,309 m) paved and lighted runway, VORTAC and ILS navigational aids, and is in general well equipped with amenities. The airport has been consistently upgraded, with current projects including an expanded parking area and flight service area. The City has also applied for federal funding to build a new float plane basin to service high demands by wilderness expedition companies and individuals.

The Kenai Police Department employs thirteen officers, for a relatively low population-to-officer ratio of 475:1 (Kenai Peninsula Borough 1984). Fire protection is also provided by the City, which has a fire department staffed by twelve full-time firefighters. The fire station is equipped with a 1,500-gallon crash truck, three pumpers, and a 5,000-gallon tanker. The Insurance Services Office fire service rating is five (on a one-to-ten scale), which is about average for a city of Kenai's size (Winston 1985).

Emergency medical care in Kenai is provided by the Fire Department. Patients are usually brought to the Central Peninsula General Hospital (CPGH) in Soldotna; more serious cases are treated at Anchorage hospitals (Winston 1985). CPGH, the primary health care center on the Kenai Peninsula, provides 24-hour emergency service, four-bed intensive care unit, and an obstetrics unit. The staff consists of 18 MD's, 20 RN's, and 13 LPN's. During summer 1985, the emergency room and obstetrics unit was expanded, another MD was hired, and a 16-bed chemical dependency unit was constructed.

CPGH's 45 beds have an average capacity utilization rate of 35 percent and peak use of 100 percent. Utilization has leveled off in the past year due to increased emphasis on outpatient rather than inpatient care. Demand for beds is somewhat below the national average of about 3 beds per 1000 population, due primarily to the young age of the population in the CPGH service area (Nichols 1985).

Education is provided by the Kenai Peninsula Borough School District, which operates a high school, junior high school, and two elementary schools in the City of Kenai. Total enrollment has increased from 1,252 students in October 1980 (Kenai Peninsula Borough 1984) to 1,878 in May 1985 (Overman 1985). The District employs 124 teachers at its Kenai schools, for a relatively low student-teacher ratio of 15:1 (Jewell 1985). Subject to bond issue approval by voters, a construction program would increase the capacity of Kenai's schools from 2,250 to 2,750, adequate to handle enrollment growth until about 1990, if 7 percent average annual enrollment growth occurs. In the Kenai-Nikiski-Soldotna-Sterling area, planned construction would increase total capacity to 9,475 (subject to voter approval). This increase would be sufficient to accommodate projected enrollment until the 1992-1993 school year.

4.7.1.4 Local and Regional Governance

The primary government jurisdiction in the region of the site is the Kenai Peninsula Borough. Under state law, boroughs can exercise a variety of powers, including provision of education, land use planning, platting and zoning, public safety, and other services, and may collect property, sales, and use taxes levied within their boundaries.

The Borough does not currently have a land use plan for the site area. A coastal zone management plan for the Beluga coal field area was formulated by the Borough in 1980 but was never implemented.

The State of Alaska is also an important government entity by virtue of its land holdings in the site area, permitting authority, and power to levy taxes on resource developments.

4.7.2 Tyonek

4.7.2.1 Demography

Tyonek's February 1984 population of 273 residents was approximately 95 percent Native (Fall et al. 1984). Village officials estimate the February 1985 population at 325 people. The rate of population growth in Tyonek has fluctuated throughout the past century (Table 4-19). The village population declined in the late 1800s and eventually crashed in 1918 as a result of a devastating influenza epidemic. Since 1920, the population has gradually increased with only a slight decline between the 1940 and 1950 censuses. In the 1960s, the town experienced a growth rate of about 2.4 percent annually. The population growth rate dropped during the 1970s, however, stagnating at about 0.3 percent annually. This decline in population growth was due to outmigration (McCord 1985) since both employment opportunities and subsistence resources were in short supply throughout the 1970s. The population has grown by approximately 3.5 percent annually between 1980 and 1984.

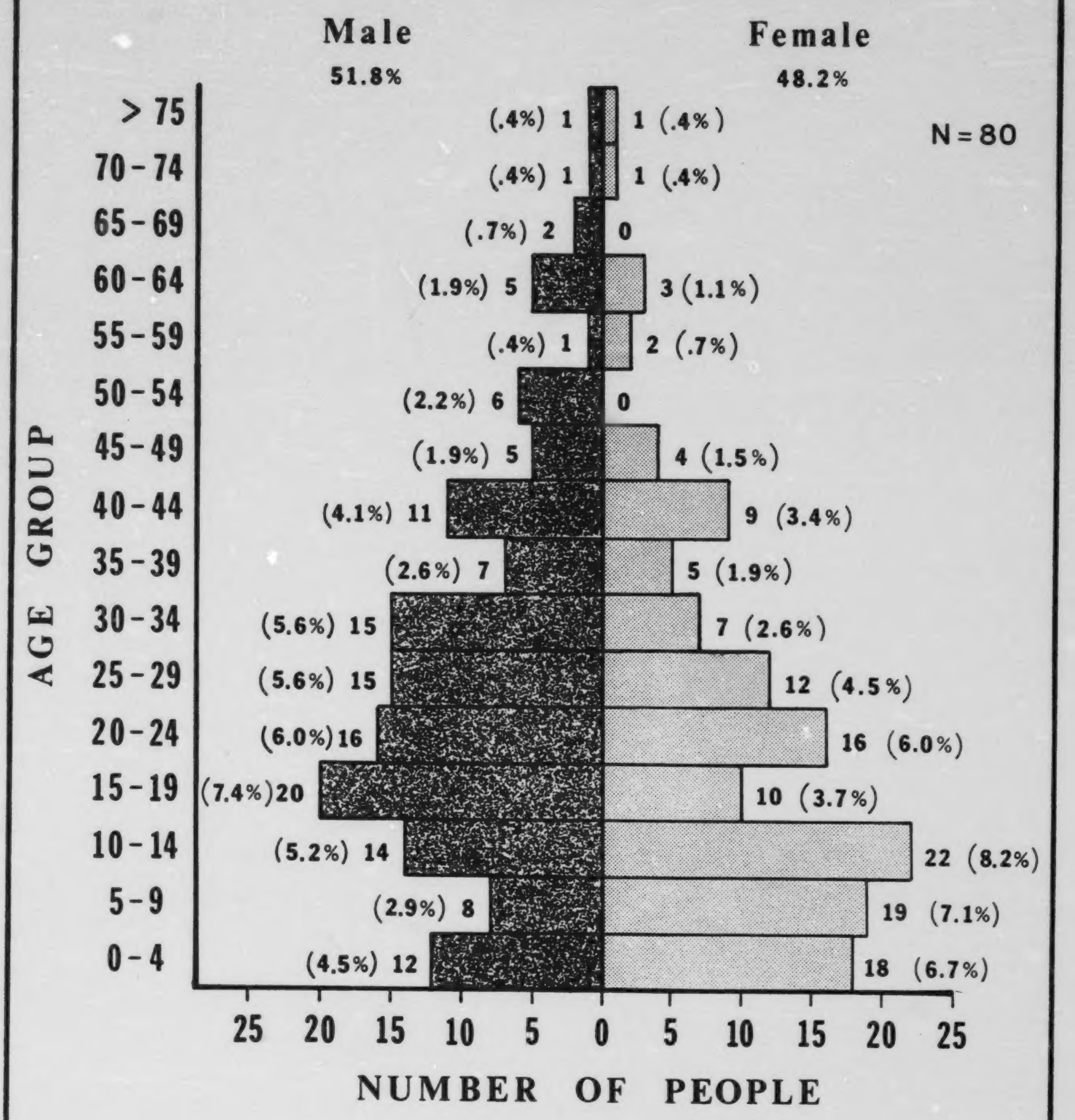
As presented in Figure 4-14, 78 percent of the population is under 35 years of age (Fall et al. 1984). Although this segment of the population was represented equally by males and females, the male/female ratio is disproportionate in certain age groups. There were 66 males and 45 females between the ages of 15 and 34. This may possibly be due to a higher outmigration of females. In contrast, there were 59 girls and 34 boys under 15 years of age.

Table 4-19

POPULATION OF TYONEK, ALASKA, 1880-1984

1880	117
1890	115
1900	107
1920	58
1930	78
1940	136
1950	132
1960	187
1970	232
1980	239
1984	273

Source: Fall et al. 1984; Darbyshire and Associates 1981a



SOURCE: FALL, FOSTER, STANEK. ADF&G, DIVISION OF SUBSISTENCE TECHNICAL REPORT #105. ANCHORAGE, ALASKA, 1984.

POPULATION PROFILE BY AGE AND SEX, TYONEK, FEBRUARY, 1984

Diamond Chuitna Environmental Impact Statement	FIGURE 4-14

4.7.2.2 Economy

Tyonek residents participate in a mixed economy that requires integration of elements of both subsistence and cash production into a unified economic strategy (Fall et al. 1984). For example, cash is required to purchase equipment necessary to harvest subsistence resources. Although the two production strategies are related, their integration is often difficult. A successful renewable resource harvester must be willing to wait for suitable weather and adapt to the seasonal availability and variable migration patterns of targeted resources. This flexibility is frequently incompatible with full-time employment. Hence, employers are often faced with absenteeism and villagers must choose between work and subsistence resource harvesting. Layoffs, seasonal job fluctuations, and chronic unemployment and underemployment are perennial problems in Tyonek. This general situation was illustrated by the construction of a logging and chip mill operation by Kodiak Lumber, Mills (KLM) in 1975. Despite high unemployment and KLM's apparent desire to hire local workers, problems similar to those described above were encountered and KLM eventually found it necessary to replace much of the Tyonek work force with non-locals. By 1979, only eight Tyonek villagers worked for KLM (Braund and Behnke 1980) compared with a maximum of approximately 30 Tyonek residents employed by KLM in 1976 (McCord 1985).

Tyonek villagers had an average 1983 household income of $12,853, with the median income about $11,000 (Darbyshire and Associates 1984a). In addition, Darbyshire and Associates found that, of a total local workforce of 145 villagers, 41 held full-time jobs in 1983 (Table 4-20). Darbyshire (1984a) estimated that an additional 63 part-time and seasonal jobs existed. Hence, 104 people were unemployed or underemployed in Tyonek in 1983, including those involved in commercial fishing and other part-time or seasonal opportunities. This high level of unemployment and underemployment is a serious impediment to the economic health of the community.

Positions with the Tyonek village council, Native Village of Tyonek (NVT) accounted for 19 (51 percent) of the 37 full-time jobs in Tyonek in 1983. These positions included: village president, equipment operators, secretaries, custodians, fire and patrol men, a nurse, health aide, and others. The Kenai Peninsula Borough employed five villagers full-time in 1983 in the school. In addition, six full-time positions were filled in private enterprises such as the local store. The remainder of the full-time positions were offered by a range of local industries including construction, transportation, utilities, and through state and federally funded programs. Changes in employment opportunities after 1983 include creation of approximately two positions in coal exploration, six carpentry positions for

Table 4-20

TOTAL VILLAGE INCOME AND EMPLOYMENT, BY INDUSTRY
VILLAGE OF TYONEK, ALASKA, 1983[1]

Industry	Full-time	Seasonal/ Part-time	Annual Income
Commercial Fishing	0	51	$ 142,500
Construction	1	1	15,000
Cottage Industry	0	2	1,500
Transportation	1	0	14,600
Communications/Utilities	2	0	30,600
Trade/Private Services	6	2	132,825
Real Estate	0	0	33,400
Village Government	19	1	282,325
Borough School	5	6	89,455
State & Federal Agencies/Services	3	0	82,000
Total Employment in Tyonek	37	63	$ 824,205
Outside Employment[2]	4	0	73,700
Transfer Payments			258,837
TOTAL VILLAGE EMPLOYMENT AND INCOME	41	63	$1,156,742

[1] Does not include Tyonek Native Corporation jobs filled by non-villagers.

[2] Residents who leave Tyonek periodically to work outside the community.

Source: Darbyshire and Associates (1984a) construction of the new tribal center, and two Chuitna River sportfish guiding businesses, one of which is based in Tyonek (McCord 1985).

The 63 possible part-time and/or seasonal employment opportunities were dominated by commercial fishing with seasonal positions available for approximately 51 people, including 26 limited entry salmon permit holders and their crew members. In 1983, 28 households derived a total income of $142,500 from commercial fishing for an average of $5,089 per household or $5,700 per permit (Darbyshire and Associates 1984a; Fall et al. 1984). In 1982, gross earnings from commercial fishing in Tyonek were slightly below 1983 fishing incomes at $4,753 per permit (Fall et al. 1984). Although data from only two years cannot be considered representative, commercial fishing earnings in Tyonek appear to be below those in other Cook Inlet fisheries. For example , gross earnings for Upper Cook Inlet set gill net permit holders averaged $9,672 per permit in 1979, $10,541 in 1980, $14,640 in 1981, $20,969 in 1982, and $16,283 in 1983 (Commercial Fisheries Entry Commission 1984).

In terms of relative contribution to Tyonek, Darbyshire and Associates (1984a) estimated private sector income including commercial fishing, village government, and transfer payments to be the most important sources of income (Table 4-21). The relationship between village government and the real estate sector of the economy requires elaboration. The Tyonek Management Corporation (TMC), a subsidiary of NVT, manages royalties from a 1965 sale of oil and gas drilling rights on the former Moquawkie Indian Reservation. TMC invested money both locally and outside the community. In 1983, rental properties in Tyonek generated $33,400, primarily through houses leased to teachers (Darbyshire and Associates 1984a). However, rental receipts from commercial properties located primarily in Anchorage essentially supported NVT and its activities. Thus, 30 percent of the economic base of the community was derived from TMC rent receipts (Table 4-21) . Private industries (including commercial fishing, construction and merchandise) accounted for 24 percent of the economic base and public sector funding represented 46 percent of Tyonek's economic base. Although the reliance on the public sector is substantial, especially in terms of direct transfer payments, Tyonek's dependence on state and federal programs is far less than most rural Alaskan villages (Darbyshire and Associates 1984a).

Table 4-21

TYONEK'S ECONOMIC BASE, 1983

Basic Industries	Percent
Private Activities	24
TMC Rent Receipts	30
Kenai Borough School Funding	10
State and Federal Services Funding	9
State and Federal Transfer Payments	27
	100

Source: Darbyshire and Associates (1984a)

4.7.2.3 Community Facilities and Services

Due in large part to oil and gas lease income in the 1960s, Tyonek has been able to continually develop and upgrade community facilities and services to meet the needs of the community. The oil and gas royalties supported construction of new village housing in the mid-1960s and contributed to construction of the school. Investment income from the royalties has allowed continued infrastructure development to meet the changing needs of the community.

Housing needs are filled by approximately 60 prefabricated homes that Tyonek built in 1965 and 27 houses that were built in 1978-79 with funds from Housing and Urban Development (HUD) and Cook Inlet Native Association (CINA) (Darbyshire and Associates 1981b). Public utilities available to Tyonek residents include water (treated with chlorine and flourine), telephone service, and electric service. In the late 1960s, Tyonek sold an electric generating unit to Chugach Electric Association in trade for an electricity allotment. In 1982, Tyonek's consumption was 4.7 million kilowatt-hours; by mid-1983, 11.9 million kilowatt-hours remained in Tyonek's allotment (Vecera 1985). Chugach Electric Association officials estimated that, at current rates of consumption, Tyonek would begin paying for electricity by 1986.

Sewage disposal (using septic tanks and leach fields) and solid waste disposal (at a landfill 6.4 km (4 mi) south of Tyonek) needs are filled on an individual basis. The E.L. "Bob" Bartlett School, constructed in 1967 by the Bureau of Indian Affairs and NVT and added to in 1976 by KPB, offers education for grades K-12. The school, which is operated by KPB, includes a library, full kitchen, gymnasium, and multipurpose room, as well as classrooms and offices.

A local health clinic accommodates health care needs, although residents commonly use hospitals in Anchorage for all but minor health needs. The village clinic is operated by a full-time CINA aide and a part-time CINA representative. In addition, personnel from the Public Health Service and the Alaska Native Service visit Tyonek periodically to provide health care (Darbyshire and Associates 1981b).

Other social services offered locally are administered by the NVT and supported by funds from CINA as well as various state and federal programs. These services include counseling, drug and alcohol abuse programs, day care, adult and child protection, and employment assistance (Darbyshire and Associates 1981b). In addition, CINA funds are used to support three local firemen. Public safety needs are further filled by a village public safety officer and two village security officers in Tyonek and a State Trooper in Beluga (Darbyshire and Associates 1984b; Fall et al. 1984).

Additional community facilities include a guest house/day care center, snack bar/recreation center, post office, heavy equipment shop, and community center that houses village offices (Darbyshire and Associates 1981b, 1984b). A new tribal center, funded by an HUD Community Development Block Grant, is nearing completion. It includes offices for the village government and various social service programs as well as a large public hall that will be used for village gatherings. Finally, other community service needs are filled by the private sector, including the village store and two Anchorage-based air taxi services that provide numerous daily flights between Tyonek and Anchorage.

4.7.2.4 Local Government

The Tyonek village council, under the name Native Village of Tyonek (NVT), is a federally chartered Indian Reorganization Act (IRA) council that is recognized as the local governing body for the village. The council has been active in the development of the community and its facilities for many years. Its responsibilities cover Tyonek's public affairs, public utilities, and management of village-owned lands and buildings. The Kenai Peninsula Borough administers the school and is responsible for operation of the landfill, though this function has been subcontracted to the village.

When the Alaska Native Claims Settlement Act (ANCSA) passed in 1971, Tyonek chose to participate in the Act rather than receive title to the former Moquawkie Indian Reservation. In doing so, surface title to the 10,893 ha (26,917 ac) reservation was transferred to Tyonek Native Corporation (TNC), a profit village corporation created by ANCSA, as part of its 46,621 ha (115,200 ac) entitlement. The subsurface estate of these lands was conveyed to Cook

Inlet Region, Incorporated (CIRI), one of 13 regional Native corporations created by ANCSA. Although the Native Village of Tyonek can retain ownership of up to 518 ha (1,280 ac) for municipal expansion (under Section 14(c)(3) of ANCSA), these lands have yet to be conveyed (McCord 1985). Thus, NVT lost control over both surface and subsurface uses on the former reservation lands to TNC and CIRI through ANCSA. Because both TNC and CIRI are motivated in part by profits from their land and investments, there are occasional conflicts of interest between these profit corporations and the people of Tyonek (Braund and Behnke 1980).

The State of Alaska and KPB are also major land owners in the area. Although the State does not take an active role in Tyonek's local government, state land policies nonetheless affect the nature and extent of development and land use near Tyonek (for example, through issuance of coal leases). Similarly, KPB controls surface uses in the Congahbuna and Viapan Lake areas. Both of these locations have been identified as possible settlement sites in the Susitna Area Plan (Alaska Department of Natural Resources 1984). Both the State and KPB must be considered key political players in the area.

4.7.2.5 Community Attitudes Toward the Diamond Chuitna Coal Project

Previous research efforts have produced conflicting reports on Tyonek residents' attitudes toward coal development in their area. Whereas Darbyshire and Associates (1981a) found that only 20 percent of Tyonek residents opposed development of the Beluga coal fields, other studies (Braund and Behnke 1980; Pacific Northwest Laboratory and Battelle Human Affairs Research Center 1979; DOWL 1981) indicated general disapproval for such development. As reported by these studies, Tyonek residents' concerns centered around increased outside influence on the community, disruption of their subsistence livelihood (through habitat disruption, increased competition for wildlife, or potential difficulty with access to hunting areas), and general village disruption. Field interviews conducted in January 1985 suggest that many of these concerns still prevail in Tyonek.

The January 1985 fieldwork conducted in Tyonek revealed that local attitudes toward specific aspects of the Diamond Chuitna project ranged from vehement opposition to enthusiastic support. Individuals strongly supportive of coal development invariably cited the expected increases in local employment opportunities as the major benefit to the community. Opposition to the project was based on the perceived sociocultural impacts, changes in local resource use patterns, and effects to the surrounding environment. Specifically, these concerns included:

- Effects of pollutants (especially coal dust, acidic runoff, and sewage) on fish, plants, and water quality

- Changes in fish and wildlife availability due to:

  - fish and game habitat disruption
  - stream blockage
  - increased activity that could drive fish and game away
  - overhunting by workers associated with the coal mine
  - increasingly restrictive hunting regulations should overhunting occur
  - disruption of moose migrations and traditional hunting patterns

- Disruption of the local sportfish guiding business due to increased competition for fish and reduced wilderness qualities

- Erosion of Tanaina culture and the rural way of life

- Increased outside influence in the community that could lead to:

  - loss of local control
  - increased traffic of drugs and alcohol into the community
  - increased competition for fish and game from non-locals
  - increased trespass onto Tyonek land
  - pressure for a road connection to Anchorage.

According to the interviews, the Tyonek residents who had reservations about development of the coal fields due to possible adverse social and environmental consequences realized that such development presents them with a dilemma. On one hand, they desire economic opportunities that will generate local jobs; on the other hand, they perceive the associated costs to their culture and lifestyle to be substantial. One Tyonek resident commented. "The problem is that everyone wants a job real bad, but I am kind of scared of what it will do to life here."

Some villagers voiced a need for a viable economic strategy, either based on continuation of subsistence activities (a strategy that many view as incompatible with coal development) or dominated by wage employment. These people see coal development as inevitable and want assurance that the transition into an economy dominated by coal mining is conducted in a way that allows Tyonek to participate in the development rather than be left behind and ignored. One Tyonek resident commented, "Our life is going to be changed. At least give us a chance to change with it."

Villagers who were interviewed considered the Diamond Chuitna Coal Project as one step in an on-going process of development on the west side of Cook Inlet that may eventually result in a dilution of Tyonek's culture. One Tyonek resident commented, "I'm most worried about the future and the kids and what they can expect. Before long, there will be 800 men in the Diamond camp and then Placer-Amex (sic) will come in. Pretty soon they will connect the road to Anchorage and this will be another Kenai." Another villager said, "The biggest fear is that we are going to be pushed out of this area altogether. We will be pushed into the Inlet and nobody will care."

Throughout the field interviews, parallels were frequently drawn between Diamond Chuitna Coal Company's proposal and the performance of the Kodiak Lumber Mill that operated at North Foreland in the late 1970s. According to the Tyonek interviews, agreements between KLM and Tyonek regarding worker conduct, preferential local hiring, and a no guns/no hunting policy were apparently violated, ignored, and subverted. For example, villagers indicated the no hunting policy worked until moose season opened; by 1979, few villagers worked for KLM; Tyonek Creek was blocked with sawdust and debris; the frequency of trespass increased; an ancestral cemetery was disturbed; and cables and trash were discarded on the beach and remain to this day. Tyonek residents use this recent experience as the standard for evaluating the merits of proposals to develop the coal deposits and the performance of developers in the area.

In summary, despite the advantage of enhanced local employment opportunities, many Tyonek residents were skeptical about the Diamond Chuitna Coal Project and pessimistic that any agreements will be carried out in good faith. This skepticism is in part due to the performance of KLM, but is compounded by perceptions that Tyonek is being excluded from the planning process and is powerless to affect the outcome of major land and resource use decisions for the area. One resident said, "They have planned everything off of our boundaries. It seems like they are going all around us without working with us."

4.8 SUBSISTENCE

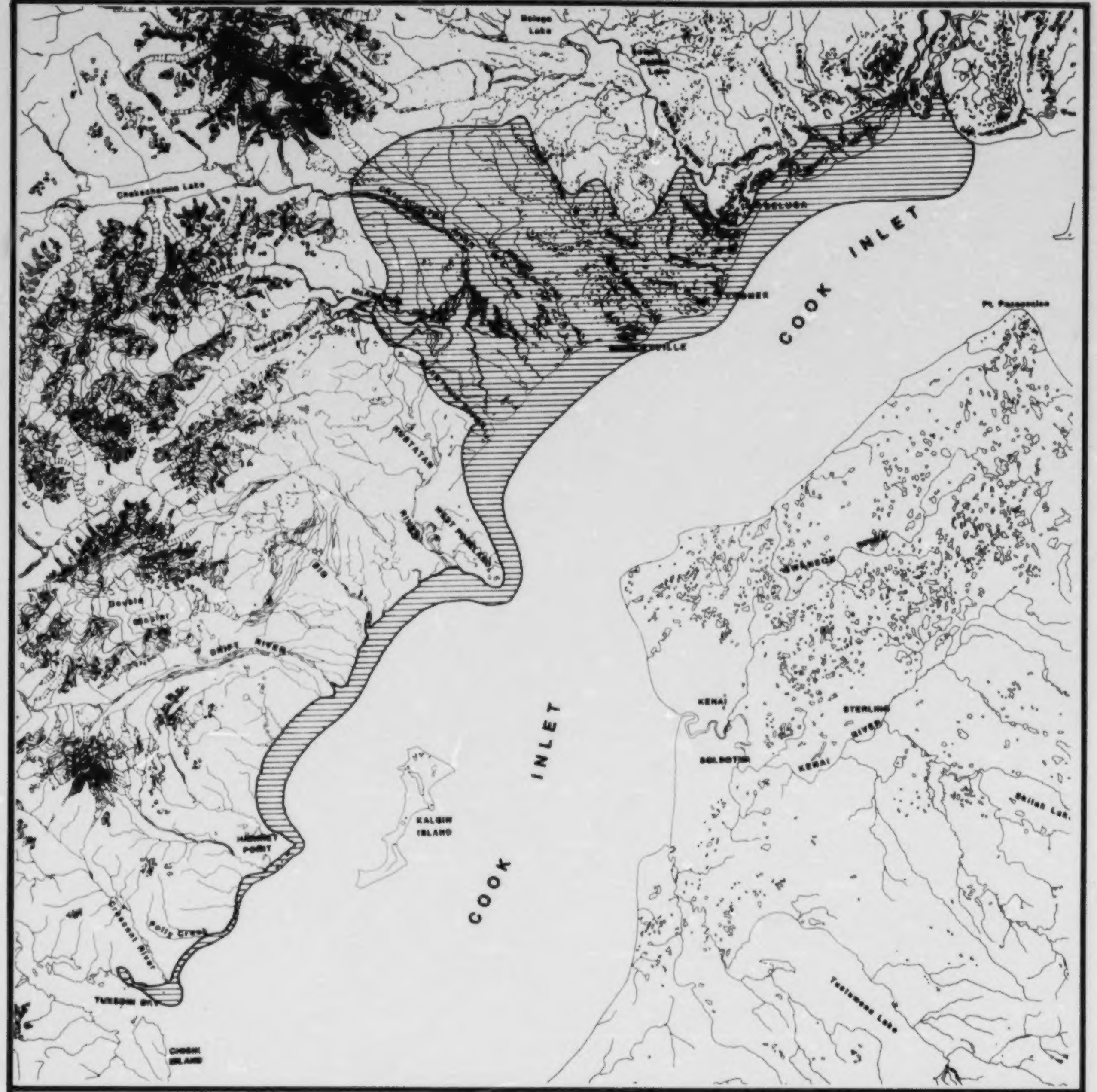
The harvest and use of subsistence resources are important to Tyonek residents for three reasons. First, locally available wild resources are less expensive than, and often nutritionally superior, to store-bought goods. Second, subsistence resources can be a supplement or partial replacement for income derived from wage employment. As such, time and money spent obtaining subsistence resources can be adjusted depending on need, opportunities for wage employment, and success of recent cash generating activities such as commercial fishing. Finally, the harvest, use, and distribution of these resources is integrally tied to Tyonek villagers' social and cultural value system (Fall et al. 1984). Therefore, subsistence resource harvests must be viewed in light of food value, as a component of an overall economic strategy, and as a central focus of the social and cultural value system.

Figure 4-15 shows the overall resource use area for Tyonek residents from 1978 to 1984 based on a study by the Alaska Department of Fish and Game (ADF&G) from 1980 to 1983 (Fall et al. 1984). Tyonek's subsistence harvesters use a 1942.5 km^2 (750 mi^2) area generally west and northwest of the village and 217.2 km (135 mi) of coastline along the western shore of Cook Inlet (Fall et al. 1984). Methods and ease of access play a major role in determing Tyonek's use areas. Dories are used to travel along the coast and into the McArthur River flats. The road network, developed to facilitate logging and oil and gas exploration, is heavily used to access upland areas.

Although Tyonek residents harvest a wide variety of subsistence resources, moose and salmon are the most important in terms of nutritional contribution to their diet (Fall et al. 1984). In 1983, of a mean subsistence harvest of 359.6 Kg (964 lb) per household, 71 percent of the edible weight was salmon, primarily king salmon taken during a May 15 to June 15 subsistence fishing season. Moose comprise 21 percent of the 1983 edible harvest weight. The remaining 8 percent of the harvest included a variety of resources including other salmon species, porcupines (*Erethizon dorsatum*), berries, razor clams (*Siliqua* sq.), waterfowl (especially mallards [*Anas platyrhynchos*], pintails [*A. acuta*], and green-winged teal [*A. crecca*]), smelt (eulachon), rainbow trout, Dolly Varden, belukha whale, harbor seal, beaver, spruce grouse (*Canachites canadensis*), and ptarmigan (*Lagopus* sp.). A variety of furbearers, including red fox (*Vulpes vulpes*), weasel (*Mustela* sp.) and beaver are trapped for furs, although trapping effort is currently lower than historical levels due to low fur prices. In addition, firewood, building timber, and coal were collected by Tyonek villagers.

The area of most intensive marine resource harvest includes marine and estuarine waters from the mouth of the Chuitna River south to Granite Point. Village fish camps and fishing sites used for both commercial and subsistence salmon harvest are located along this stretch of beach.

Intensively used aquatic and terrestrial resource harvest areas include the floodplains of the McArthur, Middle, and Chakachatna rivers; Nikolai Creek; and portions of


Beluga Lake
Chakachamna Lake
BELUGA
TYONEK
COOK INLET
Pt. Possession
KUSTATAN
WEST FORELAND
BIG
Double
Glacier
DRIFT RIVER
HARRIET POINT
KALGIN ISLAND
COOK INLET
Polly Creek
Crescent River
TUXEDNI BAY
CHISIK ISLAND
SWANSON
KENAI
STERLING
KENAI RIVER
SOLDOTNA
Skilak Lak.
Tustumena Lake

NOTE: This map was compiled during 1982 with a sample of 39 Tyonek households, and updated in 1983-84, It represents areas used during 1978-1984. This map may be a partial representation of use areas by the community. Use areas change through time and are not fixed entities.

SOURCE: Fall, Foster, Stanek. ADF&G, Division of Subsistence Technical Report # 105. Anchorage. Alaska, 1984.

LEGEND COMPOSITE MAP OF ALL RESOURCE USE AREAS ▤

SCALE
0 5 10
miles

COMPOSITE MAP OF ALL RESOURCE USE AREAS, TYONEK, ALASKA, 1978-1984.

Diamond Chuitna Environmental Impact Statement | **FIGURE 4-15**

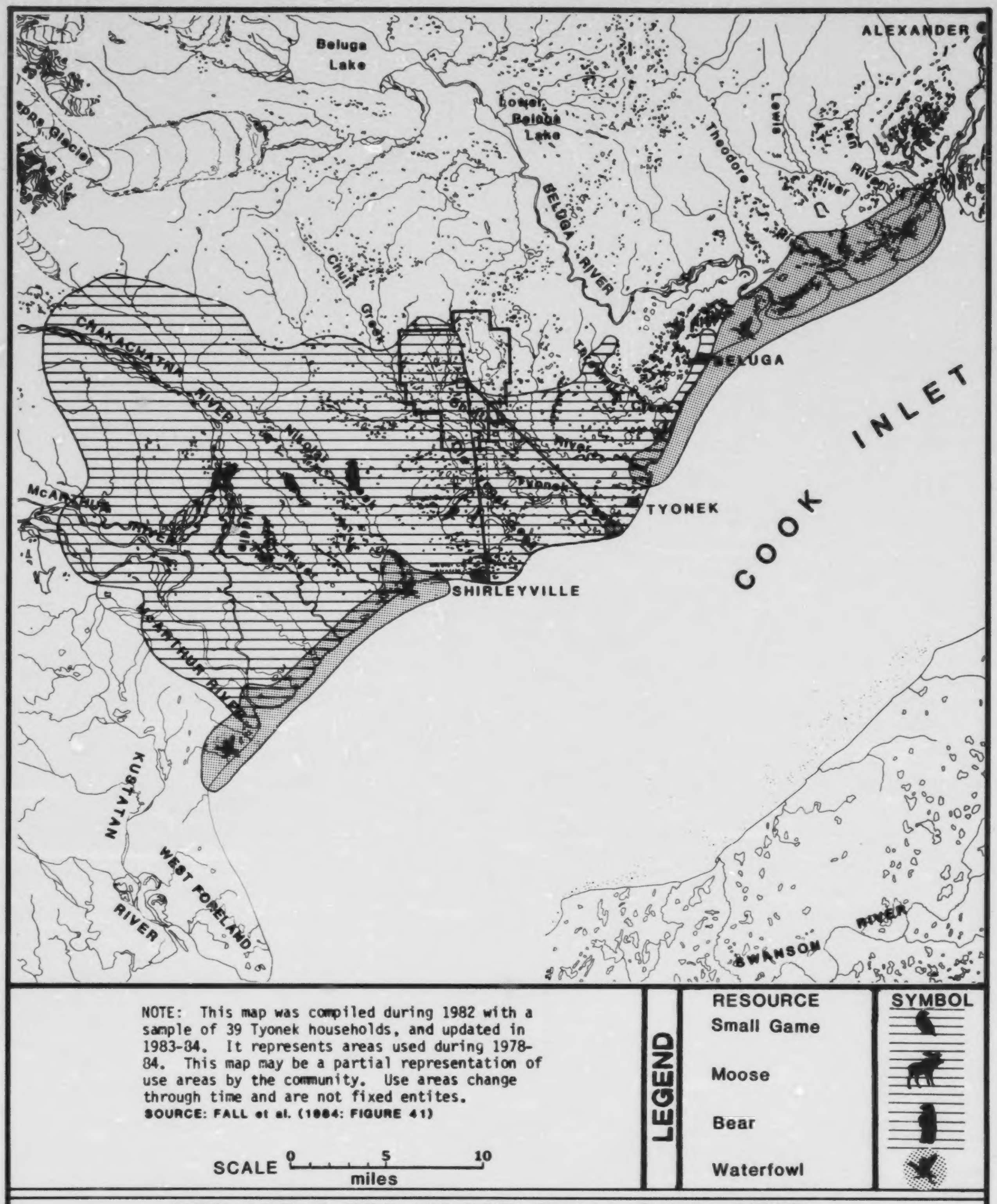
smaller creeks in the area such as Old Tyonek Creek, Tyonek Creek, and Threemile Creek. These areas receive more intensive use than surrounding habitat due to harvest efforts on instream salmon stocks, freshwater fish, waterfowl, and moose that winter in these river valleys.

Spring, early summer, and fall are generally the busiest seasons for subsistence resource harvests. May and June are dominated by the subsistence king salmon harvest and preservation. This subsistence fishery was reopened in 1980 following a 16-year closure and originally consisted of 10 fishing periods (12 hours each) between May 23 and June 15 with a household harvest limit of 50 king salmon or a total community harvest of 3,000 king salmon. Both the season length and harvest limits for subsistence fishing in Tyonek were relaxed in 1981 to allow three 16-hour openings each week between May 25 and June 15 and 12-hour openings on Saturdays from June 16 until October 15. Harvest limits were raised to 70 king salmon and 25 salmon of other species per permit holder or 4,200 kings for the community. Subsistence king harvests have ranged from a low of 1,565 in 1982 to a high of 2,750 in 1983 (Fall et al. 1984; Stanek and Foster 1980).

Other marine resources are also harvested in the early summer including smelt, razor clams, and, occasionally, marine mammals. As the season progresses, commercial salmon fishing opens in late June and continues until the runs diminish in August and September. Although these fish are taken with commercial gear under commercial fishing regulations, a proportion of the catch is usually removed and used for subsistence purposes. As the salmon runs decline, harvest efforts are transferred to moose, waterfowl, and a variety of other resources.

Moose hunting occurs during the general hunting seasons. Until 1976, ADF&G regulations allowed moose hunting during two seasons: August/September and November. The November season was eliminated in 1976 due to excessive hunting pressure. In 1983, moose populations had rebounded and a special November season was opened. Currently, ADF&G regulations allow openings for moose hunting in Game Management Unit 16B by local residents only between November 1 and January 31. According to ADF&G personnel, the winter moose season is opened when the snow is sufficiently deep to force the moose into more accessible lowland areas (Foster 1984). Tyonek residents stressed the importance of the winter moose season. During this time of year, moose are generally closer to the village, meat supplies from fall hunts have diminished, and competition is reduced because hunting is open only to area residents.

Figure 4-16 shows the area used for moose hunting between 1978 and 1984. Only portions of this area, however, are used in a given hunting season. Yearly variation in


Beluga Lake
ALEXANDER
Lower Beluga Lake
Glacier
Theodore
Lewis
River
River
BELUGA RIVER
Chuit Creek
CHAKACHATNA RIVER
Nikolai Creek
McARTHUR RIVER
River
Tyonek Creek
BELUGA
TYONEK
SHIRLEYVILLE
COOK INLET
McARTHUR RIVER
KUSTATAN
WEST FORELAND
RIVER
SWANSON RIVER
SCALE
0
5
10
miles
LEGEND
RESOURCE
SYMBOL
Small Game
Moose
Bear
Waterfowl

NOTE: This map was compiled during 1982 with a sample of 39 Tyonek households, and updated in 1983-84. It represents areas used during 1978-84. This map may be a partial representation of use areas by the community. Use areas change through time and are not fixed entites.

SOURCE: FALL et al. (1984: FIGURE 41)

USE AREAS FOR MOOSE, SMALL GAME, BEAR, AND WATERFOWL, TYONEK, ALASKA

Diamond Chuitna Environmental Impact Statement

FIGURE 4-16

moose hunting areas is determined by snow conditions, moose movements, and presence of other hunters in the area.

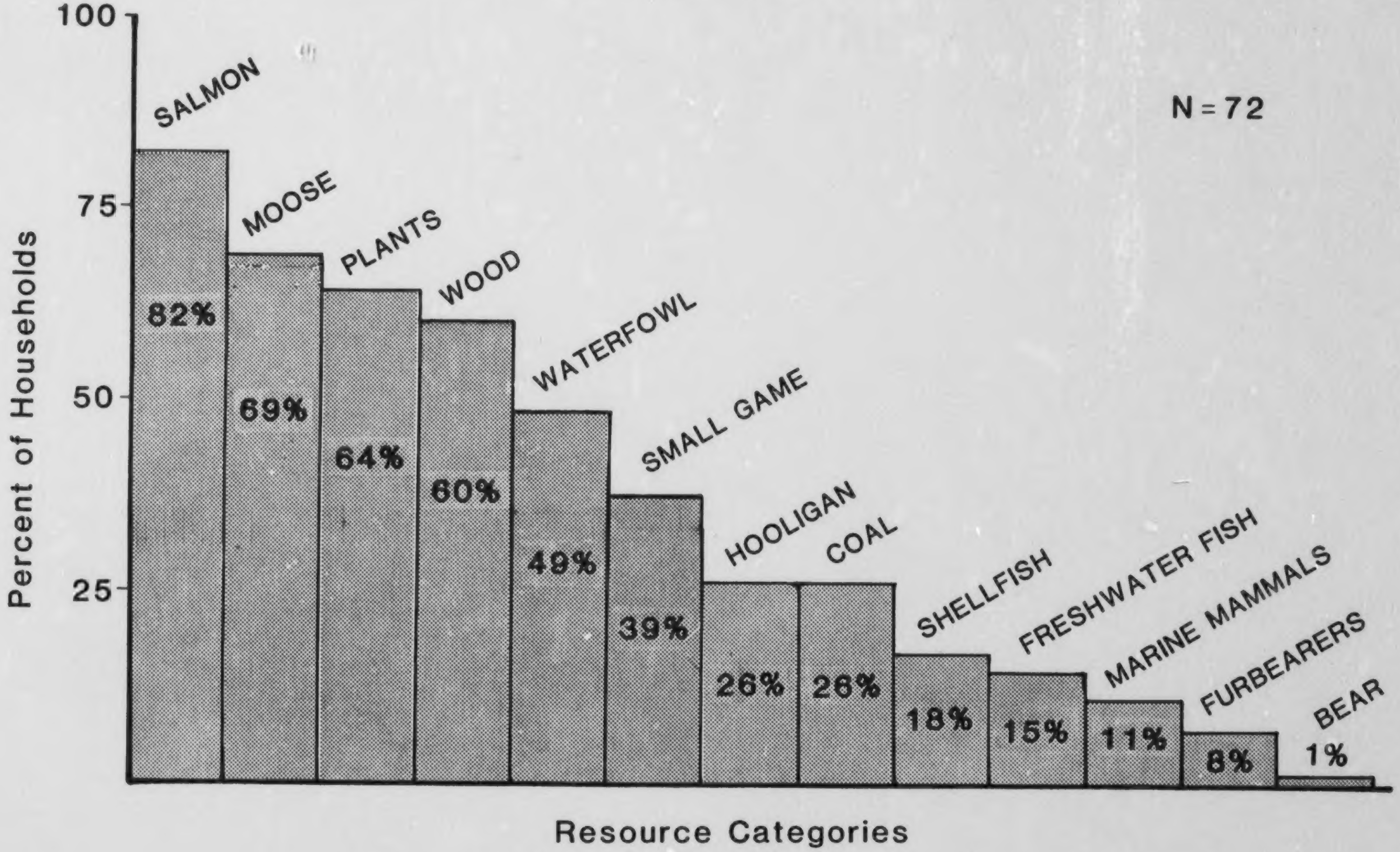
Fall moose hunting occurs primarily in the McArthur River Flats area and along the road network. Because dories are used to access the McArthur River, this area is not used during the winter. Winter harvest effort occurs primarily between the village and the Chakachatna River (Fig. 4-14). Trucks are used to travel throughout the road network; roadless areas are accessed by foot, snowmachine, or threewheeler. Although villagers indicated they once hunted moose frequently north of the Chuitna River as far as the Beluga River, this area is currently used less than previously due to increasing competition from permanent non-Native residents, especially in Beluga. Instead, winter hunting generally takes place to the southwest and northwest of Tyonek as far as the Chakachatna River.

Hunting for other species, including porcupines, grouse, and ptarmigan usually occurs incidentally while moose hunting. These species are also sought during the remainder of the year in combination with other subsistence pursuits such as ice fishing, trapping, and firewood cutting. Tyonek hunters indicated that the abundance of small game, especially porcupines, spruce grouse, and furbearers, decreased in the late 1970s and attributed this decline to logging activities of KLM.

Areas used for trapping by Tyonek residents currently include the Nikolai Creek drainage, areas along the road between the town and Granite Point including Old Tyonek Creek, and in the area north of the Chuitna River and east of Lone Creek. In addition, a trapper who does not reside in Tyonek traps throughout a broad area north of the Chuitna River from the western boundary of the Diamond Chuitna lease area, north to Beluga Lake and east to the Susitna River.

Eighty-two percent of the households in Tyonek harvested salmon in 1983 and 69 percent harvested or attempted to harvest moose in 1983 (Fig. 4-17) (Fall et al. 1984). Participation levels for other subsistence resources were lower than for salmon or moose. Although not all households in Tyonek participate in resource harvest activities, 90 to 95 percent of the households receive or exchange one or more subsistence resources in a given year (Foster 1981; Fall et al. 1984). Distribution of subsistence resources ensures that the benefits of subsistence harvests are dispersed throughout the community. Exchanges generally occur along kinship lines and are influenced by available surpluses, the number of dependents in a given household, and perceived need.

Cooperative harvest, use, and distribution of subsistence resources are important cohesive elements in Tyonek culture (Fall et al. 1984). The opportunity to hunt and



SOURCE: FALL, FOSTER, STANEK. ADF&G, DIVISION OF SUBSISTENCE TECHNICAL REPORT #105. ANCHORAGE, ALASKA, 1984.

PERCENTAGE OF TYONEK HOUSEHOLDS ATTEMPTING TO HARVEST RESOURCES BY RESOURCE CATEGORY, FEBRUARY 1983–JANUARY 1984

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FIGURE 4–17

fish is an affirmation of cultural values in an age when the dominant social, economic, and political influences tend to dilute the Tanaina culture. Continuation of traditional harvest activities, then, provides the focus of Tyonek's value system and kinship networks provide the social structure within which these traditional activities occur. Tyonek villagers want to retain these elements of their culture. It is for these reasons that Tyonek residents desire some degree of autonomy and control over the factors that influence the resources they rely on, their access to the resources, and the socioeconomic conditions that affect life in the village.

4.9 VISUAL RESOURCES

The project area is in the Coastal Trough physiographic province (U.S. Department of the Interior 1978a), which includes much of the land bordering Cook Inlet. This region is characterized by flat to rolling terrain and sparse to moderately dense vegetation. The project area is visually representative of this physiographic province, with elevations ranging from sea level at the proposed alternative port sites to about 275 m (900 feet) at the mine site and 415 m (1,360 feet) in the northwest portion of the Diamond Alaska lease area. Vegetation is generally of moderate density, consisting primarily of open mixed woods of birch and spruce in the uplands (9 to 12 m in height [30 to 40 feet]), and muskeg in the depressions and lowlands. Above 153 m (500 feet) in elevation are willow and alder shrub communities which may reach 6m (20 ft) in height. Numerous drainages and depressions exist on the site, which in combination with vegetation provide good, but not complete potential for screening of project facilities from view of the occasional visitors to the area.

The mine site and other proposed facility areas are rarely viewed due to their remoteness from inhabited areas and the low use level of nearby land and water. Lands near the proposed port sites can be viewed from nearby areas on Cook Inlet where occasional commercial, subsistence, and sport fishing occurs. Recreational use of the project area is described in Section 4.10.

Visual quality of the project site area was assessed using the U.S. Bureau of Land Management Visual Resource Management (VRM) System (U.S. Department of the Interior 1978b). The terrain unit (viewshed) used for the analysis consisted of a triangular area extending from Granite Point to North Forelands to the mine area. Because of the visual screening available from topography and vegetation, the viewshed included lands about 2 miles on either side of the proposed transportation corridor alternatives and 5 miles on either side of Granite Point and North Forelands.

As shown on Table 4-22, the scenic quality rating assigned to the area is 19 on a scale from 0 to 33. This rating is in Class A (of classes A, B, and C), which includes ratings between 19 and 33. According to the BLM criteria for categorization of an area as a potential area of critical environmental concern regarding scenic values, the scenic quality rating must be Class A and must have a scarcity rating of 5 or 6. Therefore, the project area would not qualify under these criteria. However, the Class A rating implies that some special management attention to maintaining the area's scenic quality may be merited.

Table 4-22

SCENIC QUALITY RATING FOR THE PROJECT AREA

Category	Score	Possible Range
Landform	3	1-5
Vegetation	3	1-5
Water	3	0-5
Color	3	1-5
Influence	3	0-5
Scarcity	2	1-6
Cultural Modification	2	-4-2
Total	19	0-33

The area's remoteness from large communities or activity centers tends to lower the level of concern for visual intrusions. However, an important use of the area is for wilderness expeditions such as fly-in fishing and subsistence use, for which lack of man-made visual intrusions is an important attribute. Addition of this user attitude factor would tend to raise overall concern for visual changes to the area. The net effect of low use level and high user concern is assessed as neutral and the scenic quality rating of 19 is considered representative of the overall sensitivity of the project area to change.

It should be noted, however, that a common vantage point is not from the ground, but from the air, since most travellers who see the site area fly in. Thus, the viewshed is actually larger if aerial vantage points are included. If a larger area were considered to reflect aerial views, the visual sensitivity of the area would be somewhat lowered because "cultural modifications" such as logging roads, the Beluga power station, and power lines are more visible from the air. The presence of these man-made influences tends to lower scenic quality ratings according to the VRM methodology.

4.10 RECREATION

The primary recreational uses of the site and its environs are fly-in fishing expeditions, non-subsistence moose hunting, and some hiking, camping, and picnicking by Tyonek residents (see Section 4.8).

4.10.1 Sport Fishing

The project area, particularly the Chuitna River, provides excellent coho and king salmon fishing. The Chuitna is open for coho salmon fishing in its entirety and, since 1983, has been open for king salmon from Cook Inlet to the mouth of Lone Creek. These areas are accessible from Tyonek and nearby airstrips via abandoned logging roads and are fished during June-July for king salmon and July-August for coho. While there is good potential for a rainbow trout fishery on the upper Chuitna, lack of access probably limits use of upstream areas. However, good rainbow fishing is available on the lower Chuitna early in the season. Kings and red salmon are also taken in this area.

At least two wilderness fishing operations regularly use the permit area. Clients are picked up at the Tyonek or Superior airstrip and driven to the Chuitna River or Lone Creek, then picked up at day's end. One operator has developed a trail network along the river banks and has built a lodge near the Chuitna River-Lone Creek confluence. Permit area waters are seldom fished. Although good fishing is available, fishing guides do not use either Nikolai or Threemile Creek, which are fished primarily by local residents for kings and red salmon.

In 1983, between 4,000 and 5,000 man-days of fishing effort are estimated to have been spent in Western Cook Inlet (including all streams north of the MacArthur system and south of the Lewis River). Most of this effort was on the Chuitna River. The king salmon fishery accounted for approximately 2,000 man-days of this total (the 1984 king salmon run attracted a similar level of use). The Chuitna River king salmon fishery is excellent, with harvest rates over 0.5 fish per man-day. The Chuitna River king salmon population is presently underharvested (Hepler 1985). The Chuitna River coho salmon fishery attracts somewhat lower fishing effort, but probably still accounts for most of the 4,000 to 5,000 man-days spent in Western Cook Inlet not represented by king salmon. No data are available on the level of effort for rainbow trout (Delaney 1985).

4.10.2 Hunting

Sport hunting in the project area is largely restricted to moose hunting. Waterfowl may be taken opportunistically on lakes in the area, but most waterfowl hunting takes place in the Trading Bay or Susitna Flats State Game Refuges.

Brown bear are not harvested except occasionally in "defense of life and property." In the vicinity of the Beluga River, approximately twenty hunters per year hunt black bear. There are no statistics available to indicate success. Ptarmigan are also occasionally hunted in the area.

Moose hunters number about 150 per year. Hunters usually arrive in Tyonek by air or boat and hunt from the road system. Tyonek residents provide some support facilities for hunters in their area. Hunts are held in the fall and in the winter. In 1984, ADF&G issued 48 permits for the winter moose hunt and in 1985, 67 permits were issued. Statistics indicate there is an approximate hunter success rate of 25 to 50 percent.

4.10.3 Other

Other possible recreational uses of the project area include recreational trapping and waterfowl hunting by non-Natives and picnicking, camping, and sight-seeing by the Tyonek villagers. Data on recreational trapping and waterfowl hunting by either Natives or non-Natives is unavailable, but some occasional use may occur.

4.11 CULTURAL RESOURCES

The Diamond Chuitna project area lies within a region of Alaska where relatively few archaeological sites have been discovered and even fewer scientifically excavated. Current understanding of the region's cultural history is sketchy due to the lack of data. It appears as if the earliest human use of the Cook Inlet area was sometime between 8,000 and 10,000 years ago. The lowest level of the Beluga Point site, on the north shore of Turnagain Arm, produced core and blade materials in an undated context; similar materials from sites elsewhere have been assigned to the American Paleoarctic Tradition of about 10,000 years ago (Reger 1977, 1981). The next known occupation of the region, also represented at the Beluga Point site, is characterized by material dating to about 3,000 years ago, which apparently does not have obvious relationships to cultural remains elsewhere in Alaska.

Two cultural manifestations at the Beluga Point site date between 3,000 and 1,500 years ago. The earliest probably is related to the Norton culture and thus may be connected with an intrusion of Eskimo peoples or cultural traits into the area. Other sites from the same time period and possessing similar collections of cultural material are known from the general area, particularly to the north. The later complex is not well represented but may be similar to a cultural manifestation known from Bristol Bay and dating to about 500 B.C. (Ross 1971).

The late period of prehistory is represented by several sites in the general project area, including Beluga Point where the uppermost level dates to around 600 years ago. Historic sites, occupied first by the Russians, later the Americans and, throughout the period, by the Tanaina Athapaskans (the Native people inhabiting the region at the time of contact) are common in the region, though few have been extensively excavated.

Only one archaeological site is known to be present in the Diamond Chuitna project area (Gerlach and Lobdell 1983). The site is located on the elevated bluff above Cook Inlet in the Granite Point area within the confines of the coal storage area proposed by Diamond Alaska at the port site. Shallow depressions, probably representing salmon storage pits, were reported at the site (TYO-064). Further testing might disclose evidence of habitation features or debris. Archaeological survey did not disclose any other materials attributable to past human use of the immediate project area. The remains of historic cabins are located adjacent to the Ladd port site (TYO-033). The cabins, which are greatly deteriorated, are frame and log structures. No archaeological investigations have been carried out in the Northern transportation corridor. However, the nature of the terrain and the extensive vegetative cover suggests the possibility that other archaeological sites may exist.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 INTRODUCTION

The scientific and analytical bases for the comparison of alternatives summarized in Section 3.2.4 are presented in this chapter.

The No Action alternative is discussed first. Since for almost all disciplines, the impact of the No Action Alternative would be the status quo, impacts of this alternative are not discussed for each of the individual disciplines. Rather, the No Action alternative is discussed in a separate section (Section 5.2) which deals primarily with the socioeconomic impacts of no project implementation.

Section 5.3 discusses the impacts of components common to all action alternatives, i.e. impacts associated with the mine, overburden stockpile location, and mine service area. Impacts are considered for each discipline. Next, the chapter deals with the applicant's Proposed Project, which includes two port site/transportation corridor alternatives. Finally, several additional alternatives are discussed, including an eastern corridor/Ladd alternative and three housing area configurations.

The environmental consequences described for the action alternatives in this chapter assume that the level of mitigation would be as proposed by the applicant (Chapter 2.0). One of the alternatives available to the permitting agencies is to request additional mitigating measures as a condition of their respective permits. Possible mitigation measures beyond those proposed by the applicant and the environmental consequences of their implementation are discussed separately in Chapter 6.0.

Throughout the following impact discussion, various references are made to "local" impacts and "regional" impacts. For purposes of this EIS, "region" refers to the Beluga Region or the area roughly outlined in Figure 4-1. Local impacts refer to effects that occur at, or immediately adjacent to, proposed project facilities. Therefore, impacts that are "regionally significant" would normally be noticeable or measurable when considered from a regional perspective. "Locally significant" impacts would be noticeable or measurable in the vicinity of the impact but would not be noticeable on a regional basis. Regionally significant impacts could have significance on a broader scale (statewide or national) if the magnitude were large enough or the resources particularly sensitive.

5.2 THE NO ACTION ALTERNATIVE

The No Action alternative would result if at least one of the permits necessary for project development were denied or if the project sponsor chose not to undertake the project. No Action would mean that none of the activities described in Chapter 2.0 would occur. In addition, ongoing exploration activities would likely stop and Diamond Alaska would probably be required to rehabilitate existing disturbed areas. None of the impacts to the physical and biological environment described in the remaining sections of this chapter would occur and the area would essentially retain its relatively undeveloped character. Some development scars from past exploration would remain in the coal field vicinity for an indefinite time period, but they would become less conspicuous with the passage of time.

Not developing the Diamond Chuitna Coal Project could create a future need for coal mines at other locations. The extent of this need would depend on local and worldwide conditions of supply and demand. If substitute mines were developed, environmental impacts of unknown, but possibly significant, magnitude could occur at some other location(s). Whether or not the impacts would be greater or less than those that would occur at the Diamond Chuitna site cannot be determined.

If it is assumed that the No Action alternative would cause Diamond Alaska to cease exploration and predevelopment activities, then the small number of jobs that are currently supported by these activities would be lost and Diamond Alaska would turn its energies elsewhere. Failure to proceed with mine development would result in at least 848 permanent jobs not being realized over the 34-year life span of the mine. The various positive and negative socioeconomic impacts to the village of Tyonek and Kenai Peninsula communities described in subsequent sections of this chapter would not occur.

From a regional standpoint, not developing the Diamond Chuitna mine could significantly affect the course of future development in the area. Development of the project and its infrastructure would likely serve as a stimulus for development of other coal fields as well as providing the economic base for support industries (see Section 5.7). The No Action alternative would prevent or delay industrial development of the Beluga area and tend to maintain the present character of the area.

5.3 IMPACTS COMMON TO ALL ACTION ALTERNATIVES - MINE AND MINE FACILITIES

5.3.1 Impacts to Terrestrial Environment

5.3.1.1 Physiography and Geology

The major construction and operation impacts of the proposed project on physiography, geology, and soils are related to coal and gravel extraction and gravel placement for facilities and for roadway and drainage structures. Four sites (Fig. 2-16) have been selected as potential gravel mining sites. These sites would provide a maximum of 4.3 million m^3 (5.6 million yd^3) of material and riprap which would be required for facilities foundations, roadway and drainage embankments, drainage structure protection, and reclamation. Extraction of coal, gravel, and rock would deplete portions of valuable resources. The above figure includes approximately 3060 m^3 (4000 yd^3) riprap, 459,000 m^3 (600,000 yd^3) gravel or road surface material and 2.3 million m^3 to 3.8 million m^3 (3 to 5 million yd^3) unclassified fill. The impacts of specific components are discussed in the following paragraphs.

Mining operations would deplete approximately 299 million Mt (330 million short tons) of coal. A 16.8 million m^3 (22 million yd^3) overburden stockpile would be created from overburden and interburden from the initial box cut for the mine. Approximately 81 ha (200 ac) would be covered by the overburden stockpile. Consideration has been given to the stability of the overburden stockpile slopes and future slope failures on the waste pile would not be anticipated with the proposed configuration.

The earth-moving sequence proposed by Diamond Alaska would replace materials in approximately the same order as their removal. However, it is anticipated that significant mixing of overburden and interburden would still occur during their extraction and replacement in depleted portions of the mine pit. Therefore, the postmining stratigraphic sequence would be similar to, but not identical to, the premining condition.

The surface excavation required to remove the coal would substantially alter the topographic relief during mine operation. As described in Section 2.3.2, the pit face would be continually advancing as new overburden is removed. The trailing edge of the pit would also advance as overburden is dumped onto mined-out areas. In effect, a 182 ha (450 ac) hole in the ground would move across the landscape over a 30-year period. The reclaimed area behind the mine pit would be regraded to its approximate premining topography as the pit advances and, at completion of mining, the whole area would be restored. Postmining topography would be similar, but not identical, to the premining condition.

5.3.1.2 Soils

Clearing and grubbing operations for the mine and mine service facilities would directly disturb over the life of the mine about 2,050 ha (5,066 ac) of mainly organic soils, including 1,127 ha (2,785 ac) of Mutnala-Chichantna, 548 ha (1,354 ac) Mutnala, and 284 ha (702 ac) Starichkof soil types (see Tables 4-1 and 4-2 for characterizing features of the affected soils)(Bechtel 1982).

The 10-year mine area consists of 1,436 ha (3,546 ac) of which 1,047 ha (2,585 ac) or 73 percent consists of Strandline soils that have a sandy loam texture (ERT 1984d). Because of their mineral nature, these soils are valuable for revegetation. Peaty Starichkof - Chichantna soils occur on 366 ha (905 ac) of the 10-year mine area. The remaining 23 ha (56 ac) consists of Jacobsen sand and Killey - Moose River silt loams.

Because of the long period required for soil formation, soils in the Diamond Chuitna mine area are highly susceptible to irreversible, disruptive impacts from surface mining. A major long-term disturbance would result from the removal of soils and overburden to reach the coal seams.

The initial construction impact to soils would be eventually mitigated by implementation of the reclamation plan and successful revegetation. The revegetation medium would be provided by backfilled overburden with a minimum 6-inch layer of redistributed topsoil. The development of a favorable growth medium would be facilitated by addition of fertilizer and control of accelerated erosion. Development of a biologic (i.e., biologically mature) dynamic soil profile from overburden equivalent to that which currently exists would require a long time period (hundreds of years) in this subarctic climate (Douglas and Tedrow 1959; Heilman 1966; Brady 1974). The addition of a topsoil layer containing biologic components as currently planned would greatly accelerate the process of soil evolution. Thus, construction, operation, and reclamation impacts of the project on existing soils would be a long-term, but partially reversible commitment of the resource. It should be noted that a successful revegetation program, including attainment of a diverse and productive community, is not necessarily dependent upon the development of a mature soil profile.

5.3.1.3 Vegetation

Community Composition

During construction and operation, clearing for the mine would directly disturb about 2,029 ha (5,014 ac) of existing vegetation, including 1,356 ha (3,351 ac) of mixed spruce-birch woodland, 364 ha (899 ac) of open low shrub scrub/sweetgale-grass fen, and 182 ha (450 ac) of closed alder/tall shrub scrub (ERT 1985e). An additional 22 ha (54 ac) of primarily mixed spruce-birch woodland vegetation would be disturbed by construction of the mine service facilities (Table 5-1).

Vegetation would also be disturbed by mining of gravel, the extent of which would depend on the number of sites used (Fig. 2-16). Site 5 would disturb about 106 ha (262 ac) of mainly mixed spruce-birch woodland vegetation. Sites 8 and 7 would disturb 134 ha (331 ac) of mixed spruce-birch woodland and mesic graminoid herbaceous/bluejoint herb vegetation and 119 ha (294 ac) of mainly mixed deciduous woodland vegetation, respectively.

Damage to vegetation could also occur from fuel and chemical spills. The degree of impact would depend on the amount of the spill, the time of the year, type of community, and type of action required for the cleanup (Brown and Berg 1980). Spills in communities with wet, organic soils during the growing season are considered to be more damaging than those occurring in mineral soils or those occurring in winter. Spill contingency plans would help to prevent or minimize damage.

Another possible indirect impact would be the increased risk of spruce beetle infestation of native trees resulting from the spread of beetles in piles or windrows of trees created during clearing operations. Delayed burning of dead trees would increase this risk.

As might be expected, the use of topsoil as a revegetation growth medium would facilitate the establishment of vegetation and would reduce the time and effort required to attain a self-sufficient plant community (McGinnies and Nicholas 1980). Revegetation studies by Diamond Alaska on test plots in the mine area have indicated that early successional species (e.g., grasses) will readily grow on typical overburden materials even in the absence of topsoil. Estimation of the time required to attain a plant community with a similar structure and diversity to premining conditions (or a successional stage leading to such) requires extrapolation of data from similar areas and project development circumstances. Because no data are directly transferable to the Diamond Chuitna Project, conservative estimates of time required for soils and vegetation regeneration have been obtained by a review of literature documenting natural and man-assisted succession.

The time period required for vegetation reestablishment varies with ecosystem (climatic regime) and site conditions. In the absence of reclamation, secondary succession to attain premining vegetation biomass on overburden would require an estimated 20 to 40 years. This estimate is based on regeneration data, including studies on secondary succession and revegetation after complete soil disturbance.

Table 5-1

AREA (ha [ac]) OF VEGETATION DISTURBED BY VARIOUS MINE COMPONENTS

	Vegetation Unit[1]									
Project Component	1	2	3	4	5	6	7	8	9	Total Area (Ha[ac])
Mine and Mine Facilities										
Mine	-	-	-	20 (49)	1356 (3351)	-	182 (450)	364 (899)	101 (250)	2029 (5014)
Mine Service Area	-	-	-	-	14 (35)	-	-	8 (20)	-	22 (54)
Housing Facilities and Airstrip (Lone Creek)	-	-	-	-	(62) 25	-	(4.9) 2	(2.5) 1	(2.5) 1	(72) 29
TOTAL	-	-	6 (14.8)	20 (49)	1395 (3447)	-	184 (455)	373 (922)	102 (252)	2080 (5140)

[1] Vegetation Units (ERT 1985e) are as follows:

1 - Closed broadleaf forest/paper birch
2 - Open broadleaf forest/balsam poplar
3 - Open mixed forest/spruce-birch
4 - Needleleaf woodland/black spruce
5 - Mixed woodland/spruce-birch
6 - Open tall shrub scrub/willow
7 - Closed tall shrub scrub/alder
8 - Open low shrub scrub/sweetgale-grass fen
9 - Mesic graminoid herbaceous/bluejoint herb

Natural regeneration after logging to an early successional Canada bluejoint grass community occurs relatively quickly in the project area (ERT 1984g). However, vegetation regeneration on highly disturbed soil would be expected to require a somewhat longer period. Natural vegetation, including the establishment of willows and black cottonwood, occurred within 25 years on newly exposed glacial till and a nearly continuous cover of alder had established after 35-40 years in the moist environment of Glacier Bay (Crocker and Major 1955). Younkin and Martens (1985) indicate reinvasion of native species including trees and shrubs after four years on fertilized mine overburden in a boreal forest ecosystem in Canada (61 degrees latitude). Unassisted revegetation (20 percent cover) was attained in the same time frame in the Yukon Territory (64 degrees latitude) on pipeline overburden (Younkin and Martens 1985). Willow and alder with an herbaceous understory have established within 20 years after fire in central Alaska (Lutz 1956). However, the establishment of a diverse, relatively mature community from natural succession alone could take 50 to 100 years (Rowe and Scotter 1973; Hettinger and Janz 1974).

Implementation of reclamation procedures as currently planned would facilitate and accelerate the reestablishment of self-perpetuating plant communities on disturbed sites within the project area. Using results of previous work (Younkin and Marten 1985; Crocker and Major 1955; Lutz 1956; Vierick 1982), it is postulated that well-developed stands of herbaceous and shrub vegetation would be established 5 to 10 years after commencement of reclamation. Self-perpetuating vegetation with sufficient cover to prevent erosion could probably be established within 10 to 20 years after reclamation. The establishment of mature shrublands and young forests would require an estimated 20 to 30 years. Reestablishment of woody communities, species diversity, and wildlife values similar to existing communities, however, could require a longer period (20 to 40 years). The use of topsoil as a revegetation growth medium would tend to shorten the time needed to obtain a self-perpetuating plant community.

Long-term adverse impacts on vegetation would occur in areas that are cleared and used continuously during mining. Reclamation operations could not be implemented until the mine service area and other mine facilities were dismantled. Thus, reestablishment of vegetation would not occur until 10 to 15 years after project completion.

Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within the mine area.

5.3.1.4 Wetlands

Of the total area directly altered by clearing for and construction of the mine and mine facilities, 443 ha (1094 ac) or 22 percent is classified as wetlands according to the criteria presented in Section 4.3.2.3 (Table 5-2). In addition to direct adverse impacts, wetland structure and function would be altered adjacent to project facilities by blockage of natural drainage patterns and disturbance of wetland inhabitants.

Some wetland areas would probably become reestablished in low areas following reclamation of the mine area. However, because of unknowns regarding postreclamation soil permeability and water tables as well as the long period of evolution that is required to create natural peatlands with their inherent water holding capacity, it is likely that the extent of wetlands would be much smaller following reclamation than prior to mining. Most wetlands within the reclaimed mine area would lack the peat and organic material which characterize the existing wetlands. Mineral soil substrate with sparse sedges and grasses would initially predominate in wet areas. In the very long term (hundreds of years), organic matter would accumulate and some peat growth would probably occur, bringing the area closer to its initial condition. As a partial mitigation measure to offset this loss of peatlands, Diamond Alaska plans to include establishment of 2 to 5 acre peat-filled depressions as part of their reclamation plan. In addition, reclaimed sedimentation basins would be selectively revegetated to accelerate the buildup of organic components. These experimental measures would alleviate wetland impacts to some extent but would cover a small surface area compared to the area of existing wetlands.

Wetland-related impacts to vegetation and wildlife for each alternative are presented in subsequent sections. The following paragraphs address wetland impacts in relation to the special values presented in Section 4.3.3.

Most wetland-related plant and animal productivity would be lost during operations, for a substantial period thereafter, and possibly indefinitely depending on the success of wetland reclamation. The acidic, muskeg-type wetlands which are widely dispersed throughout the area are not especially productive and the net primary productivity of replacement communities would probably be as high or higher than the communities which now exist. Therefore, adverse impacts resulting from overall loss of primary productivity would probably not be significant on a regional scale. Food webs would be interrupted locally (in the immediate vicinity of the disturbed wetland), but such interruption would probably not be significant on a regional basis because of the isolated nature of most area wetlands and the presence of similar wetlands outside the project area.

Table 5-2

HECTARES (ACRES) OF WETLAND LOST AS A RESULT OF MINE DEVELOPMENT BY PROJECT COMPONENT

	Wetland Type[1]							
Components	$\mathrm{PFO}\frac{4}{1}$	$\mathrm{P}\frac{\mathrm{SSI}}{\mathrm{FO4}}$	PFO4	PSS1	$\mathrm{P}\frac{\mathrm{SS1}}{\mathrm{EM5}}$	PEM5	POW	TOTAL
- Mine Components								
30 year mine limit[2]	2.4ha(6ac)	--	--	21.5ha(53ac)	329ha(813ac)	329ha(813ac)	23ha(57ac)	440ha(1086ac)
Mine Service Area	0.4ha(1ac)	--	--	2.8ha(7ac)	--	--	--	3.2ha(8ac)
- Tranportation Corridors								
Southern Corridor haul road & conveyor system	2.4ha(6ac)	--	--	0.4(1ac)	10.5ha(26ac)	0.4ha(1ac)	0.4ha(1ac)	14.2ha(35ac)
Material Sites								
(a) #5	--	--	--	--	1.2ha(3ac)	--	--	1.2ha(3ac)
(b) #7	--	--	--	--	--	--	--	--
(c) #8	--	--	--	0.8ha(2ac)	1.6ha(4ac)	0.4ha(1ac)	--	2.8ha(7ac)
Eastern Haul Road and conveyor system	--	--	0.8ha(2ac)	0.8ha(2ac)	11.3ha(28ac)	1.6ha(4ac)	0.4ha(1ac)	15.4ha(38ac)
Northern Haul Road and conveyor system	0.4ha(1ac)	--	0.4ha(1ac)	--	25.9ha(64ac)	1.2ha(3ac)	--	27.9ha(69ac)
Northern Haul Road conveyor system (phased production)	0.4ha(1ac)	--	0.4ha(1ac)	--	25.9ha(64ac)	1.2ha(3ac)	--	27.9ha(69ac)
- Housing & Airport Facilities								
Lone Creek Site	--	--	--	--	2.4ha(6ac)	--	--	2.4ha(6ac)
Congahbuna Lake Site	--	--	--	--	2.4ha(6ac)	--	--	2.4ha(6ac)
Threemile Site	--	--	--	--	--	--	--	--
- Port Facilities								
Granite Point	--	--	6.0ha(15ac)	--	63ha(155ac)	--	1.2ha(3ac)	70ha(173ac)
Ladd Port Site	2.0ha(5ac)	6.5ha(16ac)	--	--	--	--	2.8ha(7ac)	11.3ha(28ac)

NOTE: Wetland area figures may not correspond exactly with areas in the vegetation sections because the two mapping efforts differed.

1) $\mathrm{PFO}\frac{4}{1}$ Palustrine - Forested mixed needle leaved/broad/leaved deciduous

$\mathrm{P}\frac{\mathrm{SSI}}{\mathrm{FO4}}$ Palustrine - Scrub-shrub/Forested broad leaved deciduous

PFO4 Palustrine - Forested broad leaved deciduous

PSSI Palustrine - Scrub-shrub broad leaved deciduous

$\mathrm{P}\frac{\mathrm{SSI}}{\mathrm{EM5}}$ Palustrine - Scrub-shrub broad leaved deciduous/Emergent narrow leaved persistent

PEM5 Palustrine - Emergent narrow leaved persistent

POWH Palustrine - Open water permanent

2) Includes overburden stockpile

Wetland habitat available for wildlife use within the disturbed areas would be reduced. For the most part, the wetlands in the project area are not themselves high value habitat, but the habitat diversity and forest edge associated with the interspersed wetlands contributes significantly to the overall moderate to high value of the area to wildlife, especially moose and bears. Postreclamation habitat value for moose and black bear could be less than premining (Section 5.3.1.5 and Appendix A) partly because of loss of habitat diversity now contributed by wetlands.

Significant impacts to local hydrological regimes would occur as a result of eliminating, reducing, and altering wetlands in the mine area (Section 5.3.2.1). Wetland areas affect the hydrological characteristics of their watersheds in a variety of ways depending on wetland characteristics. Wetlands in the mine area store large quantities of water and play an important role in surface water - ground water interactions (ERT 1984c). The baseline investigations indicated that the deep organic layer underlying the muskeg areas on the sides of the stream valleys forms a shallow ground-water system that contributes the majority of base flow to the streams in and adjacent to the mine area. Removal of the vegetation and organic soils would destroy this shallow system and potentially prevent restoration of streams to premining conditions. Removal of wetlands would probably also increase flood peaks in the Chuitna drainage to some extent (Carter et al. 1978); however, saturated peatlands tend to respond quickly to precipitation events and the impact of removing the muskeg would probably not be dramatic (Verry and Boelter 1978). Recharge rates within the deeper ground-water systems could be increased after mining because deep organic deposits can inhibit percolation; evapotranspiration within wetland communities removes substantial water that would otherwise be available for recharge (Carter et al. 1978). Lone Creek and stream 2003 could be affected (Section 5.3.2.1), resulting in lower minimum flows and higher peak flows.

The removal of wetlands would cause long term alteration in the quality of surface-water runoff from the mine area. Wetlands tend to remove suspended sediment from inflowing waters (Carter et al. 1978); therefore, postreclamation runoff would likely contain more sediment than at present which could affect long-term stream water quality. Peatlands also tend to lower the pH (increase the acidity) of water flowing through them, consequently, postmining runoff would probably be less acid than at present (Carter et al. 1978). Additionally, nutrients that are available as a result of organic matter decay within wetland areas would be reduced. However, it is unlikely that altered nutrient flow would significantly affect ecosystem functions within the region.

Wetland-related recreation activity within the project area is minimal and no significant impact to recreation opportunity as a result of construction, operation, and reclamation would be anticipated.

5.3.1.5 Wildlife

This section primarily addresses four adverse impacts to major species or groups: 1) direct habitat loss, which is the actual physical destruction of habitat; 2) indirect habitat loss, which is the effective loss of habitat use because of noise, human contact, or other disturbance directly associated with project construction or operation; 3) effects on animal movements; and 4) construction impacts. Impacts were viewed from regional and local standpoints.

Direct habitat loss from construction and operation of the mine itself, the mine service area, overburden stockpile, and associated roads would be approximately 2,051 ha (5,068 ac) during the 34-year life of the project. In the long term, this loss would be largely mitigated or eliminated for most species by reclamation of the entire area to reestablish wildlife habitat at least as useful and productive as the premining environment. In the short term, i.e., up to 25 years, there would be adverse impacts.

Direct habitat loss as a result of construction and operation would be significant for song bird, shorebird, and small mammal species on a local basis only. Approximately eight existing beaver colonies (Fig. 4-4) would be eliminated during the life of the mine. This, and the adverse impacts on other furbearers, would be significant on a local basis only.

For bald eagles, the loss of salmon spawning habitat with its associated eagle feeding activities, could be significant on a local basis, but would not be significant on a regional basis. Direct habitat loss for trumpeter swans, sandhill cranes, and waterfowl would not be significant.

Direct habitat loss would be significant on a local basis, and possibly on a regional basis, for moose because of elimination of approximately half of one rutting concentration area within the northern portion of the mining limit (Fig. 4-3). The factors that encourage repeated use of a specific area for rutting are unknown. Lone Ridge is an important rutting area on a regional basis. Stress from disturbance or displacement could affect breeding success or chronology and could result in reduced natality* and survival. For brown and black bears, the direct habitat loss would be of local significance due to loss of terrestrial habitat and salmon spawning habitat associated with bear feeding activities.

Indirect habitat loss for song bird, shorebird, small mammal, and most smaller furbearer populations, including beaver, could be significant on a local basis. These species, however, would likely adapt (to varying degrees) to the presence of the facilities and associated activities (Univ. Maine 1983). Indirect habitat loss would be insignificant for waterfowl, shorebirds, swans, and cranes since appropriate habitat is lacking. For bald eagles, indirect habitat loss could be significant on a local basis, unless they adapt to mining activities over time.

For moose and black bears, indirect habitat loss initially could be locally significant, but these species would likely adapt to some extent with time to the presence of noise and activities, and the degree of initial disturbance would probably decrease. Brown bears and marten, however, would likely experience significant local indirect habitat loss because of their generally strong aversion to human activity. This loss would not be significant on a regional basis.

Movements of birds and most mammal species with small home ranges adjacent to the mine area would be largely unaffected in a direct way by project activities in the mine area. However, seasonal movements of moose, bears, and some larger furbearers could be delayed or prolonged as animals seek new routes around the mine pit and other facilities. Individuals may eventually find alternate routes, although populations of moose, especially, tend to continue to use historical movement routes despite man-made obstacles such as the Trans-Alaska pipeline system.

Brown bear movements in particular could be affected because of this species' aversion to human activity. While brown bears are most numerous at higher altitudes in the more open habitats west of the mine area, smaller numbers do inhabit the lower forested areas to the south and east. If normal movements through the mine area were to be hindered by behavioral or physical barriers, brown bear numbers might be substantially reduced in the areas south and east of the mine area. This would be a significant adverse local impact and might be regionally significant if regional movements were affected.

Since the mine area would not be fenced, some animals, e.g., moose or bears, would occasionally wander into the area. These animals would usually not be harmed, but would probably need to be herded out by project personnel. In unusual cases, they may be killed (Section 6.3.1.3).

Construction activities within the mine area would likely have smaller adverse impacts upon all species than would actual mine operations because of the significantly greater noise and activity levels associated with mining operations.

Habitat Evaluation

The results of the terrestrial habitat evaluation study performed for this EIS are summarized in Table 5-3 for the mine and mine service area and presented in detail in Appendix A. Mining activities would disturb significant areas of high quality black bear and brown bear habitat as well as high and medium quality moose spring/summer/fall habitat. No trumpeter swan habitat or suitable sandhill crane habitat would be directly impacted by the mine or mine service area.

The habitat evaluation study also compared the pre-mining and postreclamation habitat values within the 10-year mine permit area based on the detailed revegetation plan presented in the Surface Mine Permit Application. As indicated in Table 5-4, the postreclamation habitat value would be significantly less for black bear and moose (summer/fall/spring). The reduced value to black bear would be primarily due to lack of berry-producing shrubs (such as elderberry, high bush cranberry, and blueberry) and succulent herbs (such as fireweed and vetch) as compared to the existing plant communities. Postreclamation summer/fall/spring habitat value for moose would be lower than existing value because some kinds of selected edible broadleafed herbaceous plants (such as aquatic emergent species) would be absent. In addition, the overall diversity would be somewhat lower, edge habitat (where wooded and open habitats meet) would be decreased, and most of the existing ponded areas would be absent.

It should, however, be emphasized that plant communities are dynamic, especially on reclaimed lands, and the communities established during reclamation would undergo a long-term succession as natural plants invade the restored communities. Eventually a more or less stable equilibrium would probably be reached. The exact nature of the post-mining plant community and its wildlife habitat value several hundred years after restoration cannot be predicted with accuracy, but it is likely that it would approach the premining condition.

5.3.2 Impacts to Freshwater Environments

5.3.2.1 Ground-water Hydrology and Water Quality

Impacts to the ground-water regime as a result of mining operations would be substantial and would affect recharge and discharge relationships; quantity, quality, and direction of ground-water flows; and quantity and quality of surface water. These impacts are unavoidable; however, with proper planning, the impacts can be minimized.

The overburden materials and coal units that would be removed during mining operations contain large volumes of

Table 5-3

DIRECT LOSS OF WILDLIFE HABITAT AND SUITABILITY OF HABITATS IN HECTARES (ACRES)
FROM MINE DEVELOPMENT BY PROJECT COMPONENT

			10 Year Mine Limit			30 Year Mine Limit
Species		Mine Service Area	Pit Area	Stockpile Areas	Roads and Settling Ponds	Pit Area
Sandhill Crane	Suitable	0	0	0	0	0
	X	---	0	0	---	0
	X	---	0	0	---	0
	Unsuitable	22(55)	564(1411)	80(200)	68(169)	2029(5012)
Trumpeter Swan	High	0	0	---	---	0
	Med	0	0	---	---	0
	Low	0	0	---	---	0
	NU[2]	22(55)	575(1438)	80(200)	68(169)	2029(5012)
Black Bear	High	22(55)	564(1411)	80(200)	64(158)	1982(4955)
	Med	0	0	0	0	0
	Low	0	0	0	0	0
	NU	0	11(27)	0	4(10)	23(57)
Brown Bear	High	22(55)	564(1411)	79(198)	64(158)	1982(4955)
	Med	0	0	0	---	0
	Low	0	0	0	---	0
	NU	0	11(27)	1(2ac)	4(10)	23(57)
Moose Spring/Summer/ Fall	High	14(35)	380(950)	47(117)	47(117)	1356(3349)
	Med	8(20)	85(212)	33(83)	21(52)	653(1612)
	Low	0	180(449)	0	0	20(49)
	NU	0	0	0	0	0
Moose Winter	High	0	0	0	0	0
	Med	0	0	0	0	0
	Low	0	0	0	0	0
	NU	22(55)	575(1438)	80(200)	68(169)	2029(5012)
Total		22(55)	575(1438)	80(200)	68(169)	2029(5012)

[1] Exact sighting not finalized.

[2] Not utilized.

Table 5-4

COMPARISON OF PREMINING AND POSTMINING HABITAT VALUES FOR EVALUATION SPECIES (10 YR MINING AREA ONLY)

Evaluation Species	Habitat Value	Premining Habitat (Hectares [acres])	Postmining* Habitat (Hectares [acres])
Black Bear	High	660 (1639)	0
	Medium	0	660 (1639)
	Low	0	0
Brown Bear	High	660 (1639)	660 (1639)
	Medium	0	0
	Low	0	0
Moose Summer/Fall	High	398 (984)	71 (178)
	Medium	257 (637)	485 (1202)
	Low	0	104 (259)

*Postmining refers to the period after revegetation has been completed and allowed to stabilize but before reinvasion of native species has reached an equilibrium - estimated as 10-100 years after pit closure.

ground water and can be considered important aquifers in the local hydrological regime (Figure 5-1). The mining operations would disrupt the natural ground-water flow regime within each of the units as they are mined. The intercepted ground-water flow would become inflow to the mine pit area where it would be collected in sumps, pumped to down-gradient offsite sediment treatment ponds, and discharged to streams.

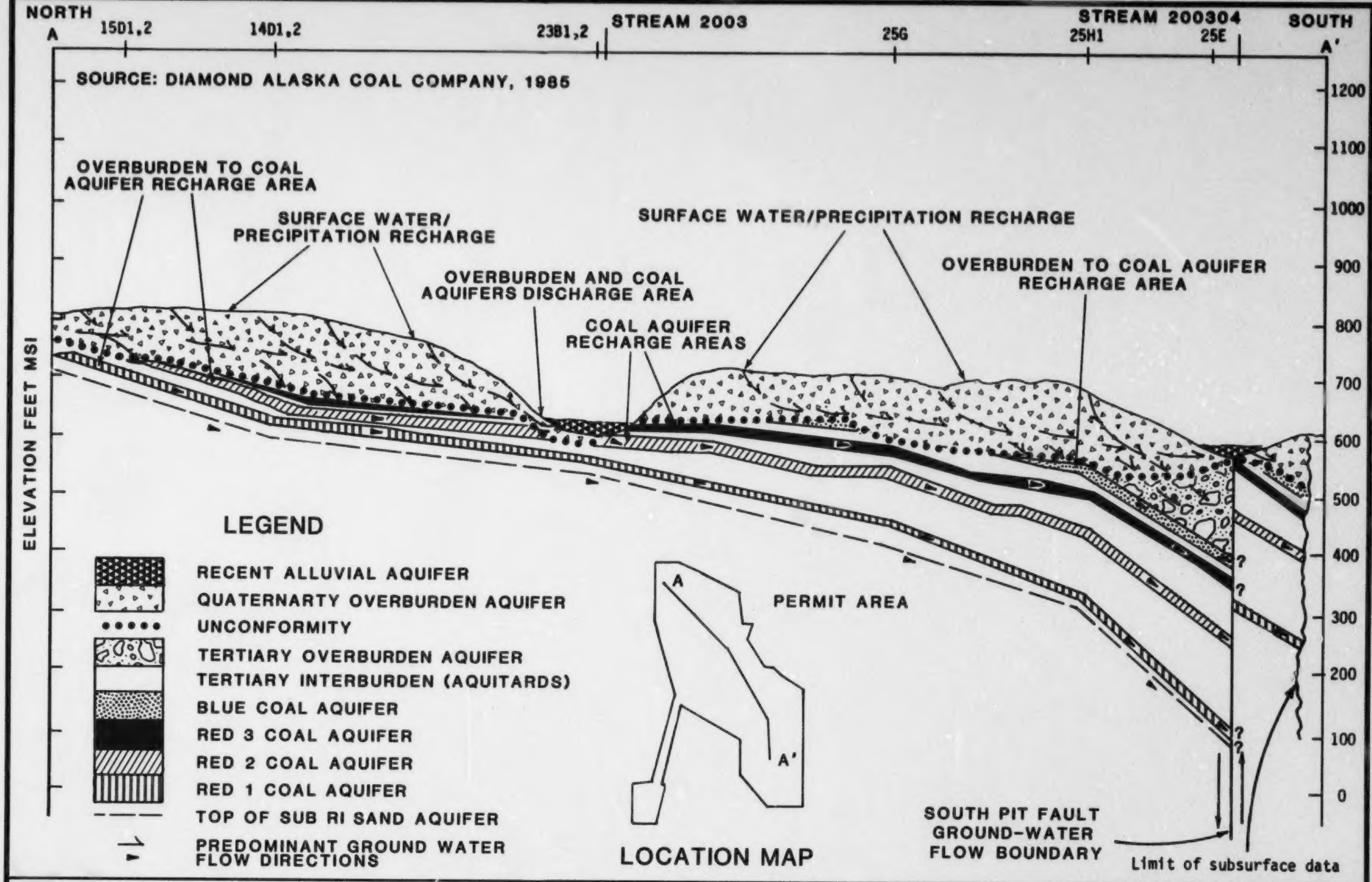
The predicted quantities of ground-water inflow to the pits as mining progresses are summarized on Table 5-5. The intercepted inflow to the pits would, in time, dewater each of the intercepted aquifers. The predicted drawdown values in the active pit after 10 years of operation are 13.7 m (45 ft) and 24.4 m (80 ft) for the overburden and coal zone, respectively. The cone of depression for the overburden aquifer is predicted to extend some 732 m (800 yd) to the northwest beyond the mine permit area, while the coal zone cone of depression is expected to extend to the mine permit boundary (Diamond Alaska Coal Company 1985).

Predicted impacts to the mine permit area as a result of the mining operations include:

- A reduction of flow in springs and streams: With time and continued mining, this impact would increase in magnitude. Impacts of interrupted base flow (ground-water input) to surface drainages would be complex. These significant impacts are discussed for each affected stream in Section 5.3.2.2.

  It is anticipated that mining operations (dewatering and lowering of the water table) would affect the ground-water regime throughout the mine permit area. However, these impacts would probably be limited to that area due to the structural faulting which borders the northwest and south sides of the permit area and due to the presence of Lone Creek to the northeast and east. Lone Creek would provide a constant source of recharge and, thus, would minimize the impact of mine dewatering to the east of Lone Creek.

- Disruption of the natural recharge due to mining operations: Natural recharge to the aquifers is predominantly the result of surface-water infiltration from both incident precipitation and snowmelt. Surface disturbance during mining and construction of support facilities and access roads would affect the potential for natural recharge. Surface-water diversions which channel flow to nearby streams would limit the opportunity for, and quantity of, water available for recharge in the mine area.


NORTH
A
15D1,2
14D1,2
23B1,2
STREAM 2003
25G
STREAM 200304
25H1
25E
SOUTH
A'
OVERBURDEN TO COAL AQUIFER RECHARGE AREA
SURFACE WATER/ PRECIPITATION RECHARGE
OVERBURDEN AND COAL AQUIFERS DISCHARGE AREA
COAL AQUIFER RECHARGE AREAS
SURFACE WATER/PRECIPITATION RECHARGE
OVERBURDEN TO COAL AQUIFER RECHARGE AREA
ELEVATION FEET MSl
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
?
LEGEND
RECENT ALLUVIAL AQUIFER
QUATERNARTY OVERBURDEN AQUIFER
UNCONFORMITY
TERTIARY OVERBURDEN AQUIFER
TERTIARY INTERBURDEN (AQUITARDS)
BLUE COAL AQUIFER
RED 3 COAL AQUIFER
RED 2 COAL AQUIFER
RED 1 COAL AQUIFER
TOP OF SUB RI SAND AQUIFER
PREDOMINANT GROUND WATER FLOW DIRECTIONS
A
A'
PERMIT AREA
LOCATION MAP
SOUTH PIT FAULT GROUND-WATER FLOW BOUNDARY
Limit of subsurface data

SOURCE: DIAMOND ALASKA COAL COMPANY, 1985

HYDROLOGIC CROSS SECTION A–A'

Diamond Chuitna Environmental Impact Statement

FIGURE 5–1

Table 5-5

ESTIMATED PIT INFLOW RATES[1]

Year of Operation	No Pit Backfill							
	3	4	5	6	7	8	9	10
Inflow to Pits from Overburden Aquifer (1/min[gpm])	484(128)	1,673(442)	1,926(509)	3,531(933)	3,852(1,018)	4,203(1,110)	4,508(1,190)	4,948(1,307)
Inflow to Pits from Coal Aquifer and Sub Red 1 Sand (1/min[gpm])	--	--	195(51)	310(82)	424(112)	516(136)	589(156)	661(175)
Total Inflow (1/min[gpm])	484(128)	1,673(442)	2,123(561)	3,841(1,015)	4,276(1,130)	4,719(1,247)	5,097(1,346)	5,609(1,484)
Total Inflow (1/day[gpd])	698,851 (184,637)	2,410,602 (636,883)	3,052,819 (807,624)	5,523,325 (1,451,197)	6,149,618 (1,626,883)	6,785,712 (1,795,162)	7,329,594 (1,939,046)	8,066,331 (2,133,950)

Year of Operation	With Pit Backfill							
	3	4	5	6	7	8	9	10
Inflow to Pits from Overburden Aquifer (1/min[gpm])	484(128)	1,673(442)	1,926(509)	3,198(845)	2,017(533)	2,540(671)	2,725(720)	1,987(585)
Inflow to Pits from Coal Aquifer and Sub Red 1 Sand (1/min[gpm])	--	--	195(51)	155(41)	159(42)	151(40)	140(37)	136(36)
Total Inflow (1/min[gpm])	484(128)	1,673(442)	2,123(561)	3,354(886)	2,176(575)	2,691(711)	2,865(757)	2,120(560)
Total Inflow (1/day[gpd])	698,851 (184,637)	2,410,602 (636,883)	3,052,819 (807,624)	4,828,835 (1,275,782)	3,130,437 (828,158)	3,870,225 (1,023,869)	4,120,393 (1,090,051)	3,050,150 (806,918)

---

[1] ERT 1985b

- Diversion of pit inflow and surface water in the mine area to nearby sediment treatment ponds: Since the treatment ponds are constructed on glacial deposits, some water would infiltrate, but most would be released as surface flow downstream of the mine area. Increased surface flows, with increased bank storage, could result in increased erosion and channelization; however, the storage capacity of treatment ponds would tend to counteract this effect by moderating extreme flows.

- High risk of ground-water degradation from fuel or chemical spills within the mine areas: Proper spill control and prevention plans, and immediate response to spills would limit the magnitude of the impact.

- Degradation of ground-water quality from leakage emanating from sewer lines and sewage treatment areas: These impacts would be insignificant in the overall context of the mining operation.

Reclamation of the mine area would at least partly reverse the ground-water impacts from mining. After removal of the surface-water diversion systems, surface water together with incident precipitation would recharge the underlying spoil materials and with time result in the reestablishment of a ground-water regime similar but not identical to the premining condition. It is anticipated that the water quality might be somewhat poorer than the premining quality due to the nature of the spoil material, i.e., intermixed clay, sand, and gravel. Postmining aquifer properties would also vary from premining conditions; however, this impact would not be expected to adversely affect the regeneration of the postmining hydrogeologic regime since the subsurface materials would probably be permeable and have some capacity for storage and transmission of ground water. The reestablishment of the ground-water regime and, in turn, reestablishment of the surface streams would likely require decades. This is governed by the necessary condition of establishing a quasi-equilibrium between the ground-water and surface-water regimes. If an equilibrium condition similar to the existing condition cannot be established, then maintenance of the baseflow contribution to streams during low flow periods might not be achievable. The elevation of the shallow aquifer water table relative to postreclamation ground surface elevations cannot be predicted with sufficient accuracy to assure base flow contribution to restored stream channels.

5.3.2.2 Surface Water Hydrology

The mine and mine facilities would occupy an area of approximately 2,051 ha (5,068 ac) including the mine pit, drainage and sediment control structures, structures for coal transportation and handling, buildings, and access roads. This area is comprised of portions of the watersheds of Lone Creek and unnamed tributaries of the Chuitna River (streams 2003 and 2004). The areal extents of the watersheds of these streams and the portions occupied by the mine and mine facilities are shown in Table 5-6.

During mine development, no surface runoff from the disturbed areas would enter any stream without passing through a sediment control structure. The stream course of Lone Creek is outside the mine limit and would not be disturbed. Surface runoff from disturbed areas along the western edge of the mine limit would be routed through sediment ponds, treated if necessary, and discharged to stream 2004. Surface runoff from the areas east of the mine pit would be routed through a system of ditches and sediment ponds and discharged to Stream 2003 and Lone Creek. The overall impacts on the downstream hydrology of these streams include moderation of flood peaks and reduction in the annual runoff contributed by the disturbed areas due to storage and evaporation in the sediment ponds.

Surface runoff from compacted gravel areas such as roads and staging areas within the mine limit would be increased to 3 or 4 times the premining conditions during the operation phase. However, these areas would be very small compared to the watersheds of the streams listed in Table 5-6. Water recovered by pit dewatering and surface runoff from the remaining areas within the mine limit would be passed through a system of sediment ponds and ditches before being discharged into streams 2003, 2004, or Lone Creek. Since precipitation (122 cm [48 in]) greatly exceeds evapotranspiration (23 cm [9 in]) in the project area, nearly all surface runoff held in the sediment ponds would eventually be discharged into the streams. Therefore, the net impact to the combined annual runoff of these streams from increased evaporation would be insignificant. The runoff peaks at the downstream boundary of the mine area would be somewhat moderated by the increased pond storage. This beneficial impact would, however, diminish as the mouth of the stream is approached and would eventually become insignificant. Impact on the Chuitna River from the above effects would not be significant.

One of the most significant physical impacts that would result from development of the Diamond Chuitna project would be alteration of the hydrology of the Chuitna River tributaries in the immediate mine vicinity (streams 2003, 2004, and Lone Creek). In general, the proposed mining plan calls for mining to progress from the northeastern corner of the property in the area of Lone Creek to the south and southwest. The mining will with time progress through a substantial portion of Stream 2003 and into several minor left bank tributaries to Stream 2004.

Table 5-6

WATERSHEDS OCCUPIED BY THE MINE AND MINE FACILITIES

	Drainage Area			Drainage Area within Mine Limit as a Percent of	
Stream	At Downstream Boundary of Mine Area	At Mouth	Drainage Area within Mine Limit	Watershed at Boundary of Mine Area	Watershed at Mouth
1. Unnamed tributary of Chuitna River Stream 2003	16.86 km^2 (6.51 mi^2) (Station C140)	39.80 km^2 (15.37 mi^2) (Station C180)	14.89 km^2 (5.75 mi^2)	88.3%	37.4%
2. Unnamed tributary of Chuitna River Stream 2004	24.39 km^2 (9.42 mi^2) (Station C080)	46.98 km^2 (17.79 mi^2) (Station C110)	5.18 km^2 (2.0 mi^2)	21.2%	11.2%
3. Lone Creek (Stream 2002)	18.52 km^2 (7.15 mi^2) (Station C200)	49.78 km^2 (19.22 mi^2) (Station C220)	2.59 km^2 (1.0 mi^2)	14.0%	5.2%

Because of important implications to fish resources, the chronology of changes that would occur within each of these streams is described in the following paragraphs. Emphasis is on potential alteration of minimum flows because such flows are most often limiting to fish. Aspects of ground-water and surface-water hydrology are integrated to provide an overall view of impacts. In the absence of detailed information regarding the progression of the mine pit and pit backfilling, schedule of transferring treated pit water to the adjacent streams, and hydrologic characteristics of the backfill material, it is not possible to accurately estimate the net reductions in the flows of affected streams. Assuming the watershed areas intercepted by mine related activities after 30 years of mining to be those shown in Table 5-6, rough estimates of the reduced streamflows after 10 years and 30 years of mining have been made (Table 5-7). These estimates assume that there will be no transfer of treated pit water back into the streams and, consequently, represent a worst case situation. Minimum flows reflect primarily base flow contributions.

The methodology used to generate the figures in Table 5-7 is described below. The premining estimated monthly minimum streamflows shown in Table 5-7 are taken from ERT (1984e). The percentage reductions used to estimate minimum monthly flows after 10 years of mining are the same as those estimated by ERT for monthly average flows of streams at selected stations (Diamond Alaska Coal Company 1985). Generally, the reductions in monthly streamflows after 10 years have been evaluated by a nearly uniform distribution of the total estimated annual reduction in 12 monthly increments with minor adjustments made by judgment. The same heuristic* methodology has been used to estimate the reduced streamflows after 30 years of mining. The ratio of the reduction in annual streamflows to the total flows is assumed to be the same as the ratio of the drainage area occupied by mine-related facilities to the total drainage area of the stream at a particular station. The resulting annual reduction is divided nearly equally in 12 monthly increments.

Since the measured monthly minimum streamflows shown in Table 5-7 are not based on any mathematical ratio, the measured streamflow per square mile of drainage area for each stream is different. Therefore, the above method resulted in some anomaly in that the sum of the estimated reductions in streamflows for the tributaries of the Chuitna River are less than the estimated reduction in the streamflows of the Chuitna River itself. To avoid the unrealistic situation of 0 winter flow, it was assumed in the case of Stream 2004 that the reductions in the monthly flows, rather than the annual flows, are in the ratios of the drainage areas occupied by the mine to the total drainage areas of the streams. In view of the assumptions stated previously, the values given in Table 5-7 should be

Table 5-7

ESTIMATED MONTHLY MINIMUM STREAMFLOWS

Stream	Drainage Area km2 (mi 2)	Estimated Minimum Flow m3/sec (cfs)											
		August	September	October	November	December	January	February	March	April	May	June	July
1) Lone Creek east of mine area, Station C200, Stream 2002	18.52 km2 (7.15 mi2)												
(a) Premining[1]		0.1 (3.48)	0.30 (10.64)	0.38 (13.43)	0.22 (7.85)	0.20 (7.31)	0.15 (5.18)	0.14 (5.16)	0.13 (4.62)	0.13 (4.60)	0.88 (31.60)	0.29 (10.47)	0.16 (5.56)
(b) After 10 years of mining[2]		0.09 (3.35)	0.29 (10.53)	0.37 (13.30)	0.22 (7.73)	0.20 (7.09)	0.14 (4.94)	0.14 (4.92)	0.12 (4.41)	0.13 (4.52)	0.88 (31.36)	0.29 (10.30)	0.15 (5.48)
(c) After 30 years of mining[2]		0.06 (2.20)	0.26 (9.36)	0.34 (12.15)	0.19 (6.57)	0.17 (6.03)	0.11 (3.90)	0.11 (3.88)	0.09 (3.34)	0.09 (3.40)	0.85 (30.32)	0.26 (9.19)	0.12 (4.28)
2) Lone Creek above confluence with Chuitna River, Station C220, Stream 2002	49.78 km2 (19.22 mi2)												
(a) Premining		0.26 (9.17)	0.69 (24.77)	0.71 (25.47)	0.48 (17.17)	0.46 (16.57)	0.38 (13.58)	0.32 (11.39)	0.26 (9.19)	0.27 (9.82)	1.60 (56.68)	0.40 (14.31)	0.22 (7.84)
(b) After 10 years of mining		0.25 (9.03)	0.69 (24.65)	0.70 (25.32)	0.48 (17.05)	0.46 (16.34)	0.37 (13.41)	0.31 (11.18)	0.25 (9.01)	0.27 (9.70)	1.60 (56.44)	0.39 (14.16)	0.22 (7.75)
(c) After 30 years of mining		0.23 (8.23)	0.67 (23.83)	0.69 (24.53)	0.46 (16.23)	0.44 (15.63)	0.36 (12.64)	0.30 (10.45)	0.23 (8.25)	0.25 (8.88)	1.58 (55.74)	0.38 (13.37)	0.20 (6.90)
3) Unnamed tributory of Chuitna River, Stream 2003, just downstream of mine area, Station C140	16.86 km2 (6.51 mi2)												
(a) Premining		0.05 (1.92)	0.22 (7.92)	0.22 (7.82)	0.11 (3.80)	0.06 (2.29)	0.08 (2.72)	0.06 (2.10)	0.05 (1.98)	0.07 (2.39)	0.34 (12.06)	0.08 (3.02)	0.04 (1.55)
(b) After 10 years of mining		0.05 (1.81)	0.21 (7.70)	0.21 (7.61)	0.10 (3.68)	0.05 (2.02)	0.07 (2.36)	0.05 (1.82)	0.05 (1.72)	0.06 (2.29)	0.33 (11.80)	0.08 (2.80)	0.04 (1.44)
(c) After 30 years of mining		0 (0)	0.12 (4.27)	0.12 (4.17)	0.004 (0.15)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.24 (8.41)	0 (0)	0 (0)
4) Unnamed tributory of Chuitna River, Stream 2003 at mouth, Station C180	39.81 km2 (15.37 mi2)												
(a) Premining		0.13 (4.66)	0.49 (17.50)	0.52 (18.42)	0.28 (10.02)	0.23 (8.25)	0.17 (6.11)	0.14 (4.94)	0.13 (4.75)	0.14 (5.08)	0.66 (23.43)	0.19 (6.90)	0.12 (4.33)
(b) After 10 years of mining		0.12 (4.54)	0.48 (17.27)	0.51 (18.21)	0.27 (9.07)	0.22 (7.92)	0.16 (5.77)	0.13 (4.60)	0.12 (4.28)	0.14 (4.98)	0.65 (23.12)	0.19 (6.76)	0.12 (4.21)
(c) After 30 years of mining		0.03 (1.09)	0.39 (13.93)	0.42 (14.85)	0.18 (6.45)	0.13 (4.60)	0.07 (2.54)	0.04 (1.37)	0.03 (1.18)	0.04 (1.51)	0.56 (19.86)	0.10 (3.41)	0.02 (0.76)

Table 5-7

ESTIMATED MONTHLY MINIMUM STREAMFLOWS
(cont'd)

Stream	Drainage Area km2 (mi 2)	August	September	October	November	December	January	February	March	April	May	June	July
		Estimated Minimum Flow m³/sec (cfs)											
5) Chuitna River downstream of affected area, Station C230	342.48 km2 (132.23 mi2)												
(a) Premining		1.68 (60.17)	5.98 (213.30)	6.82 (243.72)	3.51 (125.52)	3.08 (110.14)	2.88 (102.92)	2.22 (79.27)	1.66 (59.36)	1.88 (67.30)	15.64 (558.61)	4.87 (174.04)	1.56 (55.76)
(b) After 10 years of mining		1.68 (59.97)	5.96 (212.89)	6.81 (243.26)	3.51 (125.28)	3.07 (109.56)	2.86 (102.34)	2.21 (78.76)	1.65 (58.96)	1.87 (66.87)	15.62 (557.88)	4.87 (173.85)	1.56 (55.60)
(c) After 30 years of mining		1.41 (49.97)	5.74 (203.10)	6.61 (233.52)	3.26 (115.32)	2.83 (99.94)	2.62 (92.72)	1.95 (69.07)	1.39 (49.16)	1.62 (57.10)	15.52 (548.41)	4.64 (163.84)	1.29 (45.56)
6) Unnamed Tributary of Chuitna River, Stream 2004, Station C110, at Mouth	17.79												
(a) Premining		1.95 (68.9)	4.89 (172.8)	5.01 (177.0)	3.18 (112.4)	1.22 (43.1)	0.74 (26.1)	0.61 (21.6)	0.24 (8.5)	3.91 (138.2)	8.55 (302.1)	2.81 (99.3)	2.32 (82.0)
(b) After 10 years of mining				NO SIGNIFICANT IMPACT									
(c) After 30 years of mining		1.73 (61.1)	4.34 (153.4)	4.45 (157.2)	2.82 (99.6)	1.08 (38.2)	0.66 (23.3)	0.54 (19.1)	0.21 (7.4)	3.47 (122.6)	7.59 (268.2)	2.49 (88.0)	2.06 (72.8)
7) Unnamed Tributary of Chuitna River, Stream 2004, Station C080, About one mile upstream of mouth	9.42												
(a) Premining		1.03 (36.4)	2.59 (91.5)	2.65 (93.64)	1.68 (59.36)	0.65 (22.97)	0.39 (13.78)	0.32 (11.31)	0.13 (4.59)	2.07 (73.14)	4.53 (160.07)	1.49 (52.65)	1.23 (43.46)
(b) After 10 years of mining				NO SIGNIFICANT IMPACT									
(c) After 30 years of mining		0.81 (28.6)	2.04 (72.08)	2.09 (73.85)	1.32 (46.64)	0.51 (18.02)	0.31 (10.95)	0.25 (8.13)	0.10 (3.53)	1.63 (57.60)	3.57 (126.15)	1.17 (41.34)	0.97 (34.28)

Source: 1. ERT 1984e, 1985c
2. Dames & Moore calculations

treated as order-of-magnitude estimates to be used for qualitative assessment of potential mine-related impacts rather than quantitative indices based on measured or simulated data.

Lone Creek

The initial box cut will approximately parallel Lone Creek, but will not directly impact the stream course. Both surface runoff and the base flow contribution from that portion of the Lone Creek watershed within the affected mining area, however, will be directly impacted. The impacts to Lone Creek are expected to be greatest during low flow periods, particularly during late summer and winter, when the stream flow is comprised entirely of base flow (ground-water input). The resultant decrease in base flow contribution is estimated on the basis of maximum drainage area affected to be about 25 percent.

Another calculation method using a percent of the predicted pit inflow combined with a Glover depletion analysis (Diamond Alaska Coal Company 1985) estimated that base flow in Lone Creek would be reduced by 8.5 percent after year 10 at a stream station immediately below the mining activity. It is likely that actual maximum depletion would occur after year 10 and would be in the range of 8.5 to 25 percent. The maximum impact would be reached in the middle years of mining and would continue over the mine life. Some alleviation of impact could occur late in the mine life if ground-water recharge occurred in the backfill adjacent to Lone Creek and reached sufficient elevation so that it could begin to contribute again to base flow. However, the pit bottom, being the lowest point, would still be the principal point of collection for water within the mined out area and base flow contribution to Lone Creek from the mine area would not be fully restored until 5 to 10 years after backfilling is completed and recharge has occurred.

As indicated in Table 5-7, minimum flows could be reduced during low flow periods (late summer and late winter) by up to 25 percent within the portion of Lone Creek east of the mine. As flows increase downstream, impact would be proportionally less. The above calculations of flow reduction assume no transfer of pit drainage to Lone Creek. During the first 10 years of mining, Diamond Alaska plans to release much of its pit drainage into Lone Creek; therefore, net flow could actually increase at least temporarily. The up to 25 percent reduction would still occur in the event of pump failure or in the event that pit water freezes and cannot be pumped. Water allocation during later years of mining has not been planned but it is reasonable to assume that as the pit progesses westward, discharge from dewatering would be more likely to be released in the Stream 2003 or 2004 watersheds than into Lone Creek.

Stream 2003

Greatest impact would occur to Stream 2003 since a substantial portion of the stream and its watershed would be within the mine area. Mining would proceed in a southwesterly direction starting at the extreme headwaters of Stream 2003 and moving downstream. Thus, impact would be cumulative over the 30-year mine life with maximum impact occurring when the mine reached its maximum extent. At 30 years, about 14,200 m (46,570 ft) of stream channel would be removed along with 14.9 km^2 (5.75 mi^2) of watershed area.

As mining progressed to the southwest, the impact on Stream 2003 would continue to increase. The impact on base flow contribution to 2003 would be most pronounced during low flow periods (Table 5-7). The magnitude of the effect of base flow contribution to the stream would depend on its proximity to the active mining area. In this regard, the pit bottom, being the lowest point would be the principal point of collection for water within the mined-out areas. It would also be the "low point" with respect to existing terrain and, therefore, would induce drainage of surrounding areas. Plans provide for the accumulated surface and ground waters to be routed through a series of sedimentation/treatment ponds prior to their discharge to existing streams. In the worst case (e.g., during cold winter weather), it is projected that during at least short periods of time, there would be no direct discharge from the mine to Stream 2003 downstream of the mining area. This implies, therefore, the total streamflow in Stream 2003 may be lost for at least some distance downstream of the mine limit. The downstream point at which ground-water discharge or base flow would be sufficient to sustain streamflow throughout the year is not known, but believed to be in the range of 0.8 to 2.4 km (0.5 to 1.5 m) downstream from the 30-year mine limit because of the confluence of tributaries 200303 and 200302, both of which would be relatively unaffected by mining. Minimum flow at the mouth of Stream 2003 could be reduced by as much as 80 percent during low flow period (Table 5-7).

After cessation of mining, the backfilled and reclaimed areas would begin to resaturate by infiltration and the ground-water levels in the vicinity would tend to recover to near premining conditions. Depending upon the hydraulic conductivity and porosity of the backfill material, it may take 5 to 10 years for the restoration of ground-water levels to the premining conditions. Therefore, the impacts on streamflows shown in Table 5-7 would be expected to continue through this recovery period. As a consequence of pit excavation and mine dewatering, existing bogs and wetlands within the mine area would be eliminated. This would result in the loss of the shallow ground-water system within the organic layer that currently provides much of the input to Stream 2003. Thus, even after reclamation, the postmining monthly minimum streamflows of the affected streams would be expected to be somewhat lower than the premining values shown in Table 5-7.

The present course of Stream 2003 and its tributaries within the mine area would become extinct due to pit excavation. It is the applicant's intent to restore permanent stable channels along the approximate original courses of these streams after reclamation using established engineering techniques. However, the backfill material on which the restoration channels would be formed cannot be compacted to the same degree as the original bed material of these streams and would be susceptible to some erosion and degradation until geomorphologic equilibrium were attained. Remedial stabilization measures would probably be required during the early years of restoration. Furthermore, there would be no guarantee that the post-reclamation water table would coincide with the elevations of the recreated stream channels. Therefore, while it would be possible to reconstruct stream channels having physical characteristics similar to the existing stream channels, there is no way to predict whether the new channels would have sufficient base flow through the upper reaches to provide year-round flow similar to that which now exists.

Stream 2004

Toward the end of the 30-year mine period, several minor left bank tributaries of Stream 2004 would be mined out. The impacts of mining through these tributaries would be similar to those described for Lone Creek. These impacts would include a reduction in both surface flow and the base flow contribution to the stream. Based on drainage area considerations and the topographic relief to west of the stream course, the percentage reduction in flow is estimated to be about 21 percent of the normal flow at the time of maximum mine extent.

Possible alterations to minimum flows as a result of mining are presented in Table 5-7. Impacts to Stream 2004 would be of shorter duration than for the other mine area streams since the stream would not be affected until late in the mine life. After backfilling and ground-water recharge, base flows would be restored and long-term impact would probably be insignificant.

Chuitna River

As indicated in Table 5-7, minimum flow in the Chuitna River immediately below the mouth of Lone Creek could be reduced by up to 17 percent during low flow periods in the later years of mining. This reduction would represent an extreme worst case situation and would be unlikely during mining because of the addition of return water to the Chuitna drainage from the various mine area drainage systems. If the mine dewatering system should fail during low flow months (e.g., August, March) in the later years of mining, then a temporary flow reduction in the 10 to 20 percent range could occur. In the lower reaches of the Chuitna River where flow is greater, the impact of such a flow reduction would be proportionally reduced. Flow in the Chuitna River would also be reduced during the period following mine closure while ground-water recharge is occurring in the backfilled area. Initial reduction after mine closure could be in the 10 to 20 percent range and would gradually decrease to near 0 over a period of up to 10 years until recharge is completed. Hydrological characteristics of the Chuitna River after reclamation and recharge would not be significantly different from the existing condition.

5.3.2.3 Surface Water Quality

General Criteria

Surface water quality would be controlled by both EPA and state regulations. These regulations are based upon protection of existing and potential beneficial uses of the water as well as national water quality objectives. The most stringent requirements would be applicable. Domestic wastewater would, as a minimum, require secondary treatment. Most other water discharges from the project would be treated in upgraded sediment pond treatment systems prior to discharge. EPA criteria would require sediment pond discharge to meet the following minimum requirements (EPA 1982):

- pH in the range of 6 to 9
- During rainfall events (less than 10-year events occuring in 24 hours) that result in an increase in base streamflow or when snow or ice exist and ambient air temperature is above freezing (thaw conditions) settleable solids must be less than 0.5 ml/l
- During non-thaw or non-storm periods: 30-day average of 35 mg/l and 3.0 mg/l suspended solids and total iron respectively; maximum day value of 70 mg/l and 6 mg/l suspended solids and total iron respectively
- During 10-year, 24-hour or greater storm events, only the pH level requirement of 6 to 9 is applicable

In addition to the EPA pH, iron, and sediment standards, state standards would apply to protect the current and possible beneficial uses of the water. Generally, the ADEC receiving water standards would require (ADNR 1984):

- Turbidity

  - 5 NTU above natural background when background is below 50 NTU
  - 10% increase when background is above 50 NTU
  - 25 NTU maximum increase

- TSS/Suspended solids

  - No increase above background, can have a mixing zone

- Metals and other parameters

  - Drinking water criteria or aquatic life standards if a specific hazard to aquatic life has been identified.

The specific parameter limitations typically are modified to reflect background levels if a receiving water has normally elevated concentrations of specific parameters. The receiving water standards are based upon impacts to human and aquatic life and are therefore being used as standards for this impact analysis.

Mine and Mine Area Facilities

- Mine Site Runoff

Mine site runoff consists of surface water other than pit drainage that flows from the project area into area streams. During operation, the mining process would result in progressive disturbance and reclamation of a fixed size area. Before excavation begins in an area, surface drainages would be rerouted. Areas that had been mined would be reclaimed with interburden and overburden replaced in the same relative positions and in the same relative topographic configuration. Revegetation, routing drainage through ditches, and erosion control measures would be undertaken immediately upon redeposition of the material in the mined area (ERT 1985c).

Erosion control measures would consist of permanently developed site drainage courses, contour reclamation, mulching, temporary drainage control, revegetation, and construction of long-term sediment ponds. Eighteen sediment pond systems are planned for the mine and mine area facility. Drainage slopes and most side slopes would generally be limited to 5 percent to limit runoff velocities, although some areas would have slopes up to 12 percent. On steep slopes, alternative sediment control measures include filter dams, sediment filter fabric installations, gravel pads, chemical mulches, and matting as necessary (Diamond Alaska Coal Company 1985, Vol. XXI). Sediment ponds would be utilized until well after the entire reclaimed drainage is stabilized and runoff naturally meets background quality (ERT 1985c).

During sediment pond construction, temporary sediment control measures would be employed to limit impacts to streams. These measures could include filter fabric sediment fences, specific construction scheduling, immediate matting and revegetation or other approved techniques.

The erosion precautions noted would be designed to control major suspended solids discharges (ERT 1985c). However, test data illustrates that without further treatment, sediment discharges and corresponding turbidities would exceed proposed standards under various conditions (Diamond Alaska Coal Company 1985, Vol. XXI). Without flocculation treatment in the sediment pond systems, effluent turbidities could range from 30 to more than 14,000 NTU during major flow events (10-year/24-hour). The high range turbidity would be in excess of allowable discharge limitations. Therefore, additional treatment using polymer flocculation to increase settling effectiveness is necessary to provide compliance.

Recent laboratory bench scale and modeling tests have indicated that with a polymer flocculation-sedimentation system, effluent turbidities may be reduced to between 5 and 37 NTU* during major flow (10-year/24-hour) events (Diamond Alaska Coal Company 1985, Vol. XXI). Based upon turbidity and suspended solids correlations, Diamond and the state have estimated turbidities in receiving waters at various flood flows. Turbidity in receiving water is expected to range from 1,500 and 2,000 NTU for a 10-year, 24-hour flood event (Diamond Alaska Coal Company 1985, Vol. XXI). Therefore, all turbidity criteria would likely be met during major storm events. Compliance is further projected for 2-year, 24-hour storm conditions.

During winter baseflow conditions, stream turbidities are very low. Compliance of discharge at low baseflow conditions is not directly projected by the recent studies and modeling (Diamond Alaska Coal Company 1985, Vol. XXI). However, the conservative assumptions used, as well as limitations on discharge rates, proposed double stage flocculation for problem sediment pond systems, and possible use of controlled discharge versus stream baseflow suggests that there is enough flexibility built into the system such that compliance can be achieved.

No specific testing has been conducted to determine what potential pollutants may leach from disturbed overburden material. However, laboratory leach tests on the coal have not indicated significant amounts of metals, organics, or other potential pollutants (Bookcliffs 1985). Table 5-8 combines information from available baseline measurements to estimate water quality that could be expected from normal

Table 5-8

ESTIMATED SEDMIENT POND EFFLUENT WATER QUALITY[1] (AFTER SEDIMENTATION AND FLOCCULATION TREATMENT)

Parameter	Projected Sediment Pond Effluent Water Quality (Range)[5]	Receiving Water Quality (Range)[2]	Anticipated Receiving Water Quality Standard[3]
Alkalinity as $CaCO_3$	5.5 - 43	5.5 - 43	20 or more
Aluminum, dissolved (mg/l)	<0.1 - 0.4 (total)	<0.1 - 0.4 (total)	---
Arsenic, dissolved (mg/l)	<.005	nd	0.05
Bicarbonate as $CaCO_3$ (mg/l)	<52	nd	---
Boron, dissolved (mg/l)	<.1 - 0.52	<.1 - 0.1	0.043*+
Cadmium, dissolved (mg/l)	<.005	nd	0.004
Calcium, dissolved (mg/l)	1.4 - 10	1.4 - 9.3	---
Carbonate as $CaCO_3$ (mg/l)	0	nd	---
Chloride (mg/l)	0.06 - 13	0.06 - 4.4	200
Chromium, dissolved (mg/l)	<.02	nd	0.05
Conductivity (umhos/cm @ 25°C)	11 - 300	11 - 121	---
Copper, dissolved (mg/l)	<0.02 - 0.12 (total)	<0.02 - 0.09 (total)	1.0
Fluoride (mg/l)	0.01 - 0.3	0.01 - 0.09	2.4
Hardness as $CaCO_3$ (mg/l)	<45	nd	---
Iron, dissolved (mg/l)	0.2 - 3.4 (total)	0.2 - 3.4 (total)	0.3*+
Lead, dissolved (mg/l)	<0.02 - 0.03	<0.02 - 0.03	0.03*
Magnesium, dissolved (mg/l)	0.1 - 4.4	0.1 - 2.5	---
Manganese, dissolved (mg/l)	<0.02 - 0.2	<0.02 - 0.2	0.05*
Mercury, dissolved (mg/l)	<0.001 - 0.001 (total)	<0.001 - 0.001 (total)	0.0002
Molybdenum, dissolved (mg/l)	<.02	nd	0.07
Nickel, dissolved (mg/l)	<0.02 - 0.05 (total)	<0.02 - 0.05 (total)	0.025*+
Nitrogen, ammonia (mg/l)	<0.01 - 1.5	<0.01 - 1.5	0.020*+
Nitrogen, nitrate/nitrite (mg/l)	<0.05 - 1.5	<0.05 - 1.5	10
Organic carbon, dissolved (mg/l)	<35	nd	---
pH (units)	5.9 - 7.8	5.9 - 7.8	6.5 - 9.0
Potassium, dissolved (mg/l)	0.25 - 3	0.25 - 2.0	---
Selenium, dissolved (mg/l)	nd	nd	0.010
Sodium, dissolved (mg/l)	0.4 - 35	0.4 - 6.0	250
Solids, dissolved (mg/l)	2 - 200	2 - 104	500
Sulfate (mg/l)	0.27 - 20	0.27 - 4.5	200
Suspended Solids (mg/l)	5 - 20[4]	<1 - 60	35 mg/l+
Zinc, dissolved mg/l)	<0.02 - .08	<0.02 - 0.04	0.030*+

nd = no data

*Parameters with potential to equal or exceed standards.
+The receiving water at times equals or exceeds some of these standards now under natural conditions.

NOTES:

[1] Water quality estimates are based upon an analysis of baseline data. No actual sediment pond related tests were performed. This estimate of quality is not statistically significant and represents possible ranges only.

[2] Range from an analysis of surface water quality. Does not include peak discharge quality measurements (ERT 1985a).

[3] Standard listed is the most stringent for the various protected uses in Alaska. Sources: EPA 1976; McNeely et al. 1979; Sittig 1981; ADEC 1982; ADEC 1984.

[4] From Diamond Alaska Coal Company 1985, Vol. XXI. Note - low flow conditions critical and require additional operational modifications for compliance with turbidity regulations.

[5] Range from an analysis of surface runoff quality (ERT 1985a) and leach data (Bookcliffs 1985).

sediment pond systems. Since the information for other than total suspended solids is for dissolved material, it is assumed for the worst case analysis that sediment pond settling would not reduce metals or similar contaminant levels significantly. A comparison with baseline data in existing site streams illustrates that normal sediment pond discharge may be expected to have slightly higher levels of the elevated parameters in the baseline stream water quality. Treatment to meet state and federal standards would limit increases in total loadings in the receiving water. No pollutants significantly in excess of background levels have been observed in runoff from disturbed site test areas (ERT 1984e). No significant water quality impact is anticipated from disturbed site leaching although some present surface water has slightly elevated levels of boron, iron, nickel, manganese, zinc, and ammonia nitrogen which may continue to be periodically above standards or slightly increase. The projection of a slight increase is based upon baseline data as well as a leaching test performed on coal samples. In addition, an analysis of overburden and coal constituents and corresponding ground-water quality supports a contention that leaching would not be excessive.

As proposed by the applicant, flocculation and sedimentation treatment for excessive suspended solids, turbidity, or metals would most likely involve the use of polymers for solids removal. If required, aluminum sulfate (alum), ferric chloride, or lime could be employed for metals precipitation. Polymers are listed as "relatively non-toxic" while lime addition would result in increased pH, higher dissolved solids, and increased calcium concentrations (Hawley 1977). Toxicity of lime would normally be pH dependent. The discharge could not be allowed to be elevated to pH levels causing aquatic impacts. Low levels of alum have not been found to be toxic (Hawley 1977).

Impacts from site runoff are not anticipated to be significant with proposed treatment. With present sediment pond design and planned polymer flocculation, tests have indicated that treated pit water discharges which would occur during dry periods when high runoff exemptions are not applicable may be the worst case condition but are not projected to exceed the limits for total suspended solids with special operational limits. Refer to Section 5.4.2.3 for an analysis of potential impacts to fish and other aquatic plants and animals.

Erosion control for overburden stockpiles would be accomplished as described for the mine area. Water quality impacts from these areas are not anticipated to be different from other disturbed sites.

- Pit Drainage

The actual mine workings or pit would accumulate water from surface runoff and from ground-water seepage into the pit. This water would not drain or infiltrate from the deep pit, but would be collected in the bottom sump of the pit where settling would substantially reduce sediment loads. Initial estimates by the applicant indicate up to 70 percent removal of solids in the pit settling areas. During periods of high rainfall, the pit drainage water would be high in suspended solids. During low rainfall, most of the pit drainage water would be from ground-water drainage and would reflect the quality of the aquifers intersected and erosion and sediment from excavations.

Table 5-9 illustrates the range of projected conditions for pit water quality. When runoff predominates, sediment levels after treatment may reach in excess of 20 mg/l TSS and parameters such as boron, iron, nickel, manganese, ammonia, nitrogen, and zinc may reach or exceed standards. When ground-water seepage predominates, projected suspended solids levels would be lower. It is significant that background water quality in the receiving waters would at times also likely equal or exceed the standards for boron, iron, nickel, manganese, ammonia, nitrogen, and zinc as shown by the baseline data. Table 5-9 also lists the applicable receiving water standards which discharge from the pit collection sumps must ultimately meet.

Water which would be pumped from the pit would be discharged into site drainage sediment pond systems. This would provide additional settling. Diamond Alaska has committed to a flocculant treatment system to comply with discharge requirements. Lime or a similar flocculant-coagulant would be used for metal removal, if necessary, while a polymer would be used to enhance sediment removal.

The potential for contamination from metals appears to be small according to laboratory leaching tests. Although the Beluga low sulfur coal is non-acid generating, some metals do leach from it in minor quantities (Bookcliffs 1985). If metals treatment or treatment for excessive sediment load became necessary, a precipitating flocculant could be introduced before the sediment ponds. The flocculant would reduce both metals and suspended solids (sediment). Initial operational testing would determine the need for such pretreatment since it is difficult to determine under laboratory conditions.

The impact of the pit drainage would be most significant during low winter stream flows. In the winter, surface runoff would be minimal, while ground-water seepage into the pit would continue at near normal rates. At certain times, most of the streamflow in Stream 2003 could be from treated pit drainages. At other times (depending upon the location

Table 5-9

PIT DRAINAGE EFFLUENT WATER QUALITY PROJECTION (AFTER SEDIMENTATION AND FLOCCULATION TREATMENT)

	Projected In-Pit Water Quality		
Parameter	Rainfall Predominated[1] (Range)	Seepage Predominated[2] (Range)	Anticipated Receiving Water Quality Standard[3]
Alkalinity as $CaCO_3$	5.5 - 43	98 - 270	20 or more
Aluminum, dissolved (mg/l)	<0.1 - 0.4 (total)	<.2	---
Arsenic, dissolved (mg/l)	nd	<0.01	0.05
Bicarbonate as $CaCO_3$ (mg/l)	nd	99 - 233	---
Boron, dissolved (mg/l)	<.1 - 0.1	<0.1 - .52	0.043*
Cadmium, dissolved (mg/l)	nd	<0.01	0.004
Calcium, dissolved (mg/l)	1.4 - 9.3	17 - 58	---
Carbonate as $CaCO_3$ (mg/l)	nd	0 - 24	---
Chloride (mg/l)	0.06 - 4.4	1.6 - 13	200
Chromium, dissolved (mg/l)	nd	<0.02	0.05
Conductivity (umhos/cm @ 25°C)	11 - 121	180 - 906	---
Copper, dissolved (mg/l)	<0.02 - 0.09 (total)	<0.02 - .1	1.0
Fluoride (mg/l)	0.01 - 0.09	<.24	2.4
Hardness as $CaCO_3$ (mg/l)	nd	65 - 134	---
Iron, dissolved (mg/l)	0.2 - 3.4 (total)	0.12 - 0.96	0.3*
Lead, dissolved (mg/l)	<0.02 - 0.03	<0.02	0.03
Magnesium, dissolved (mg/l)	0.1 - 2.5	<5	---
Manganese, dissolved (mg/l)	<0.02 - 0.2	.06 - .29	0.05*
Mercury, dissolved (mg/l)	<0.001 - 0.001 (total)	<.001	0.0002
Molybdenum, dissolved (mg/l)	nd	<.02	0.07
Nickel, dissolved (mg/l)	<0.02 - 0.05 (total)	<.02	0.025*
Nitrogen, ammonia (mg/l)	<0.01 - 1.5	0.5 - 4.1 (as N)	0.020*
Nitrogen, nitrate/nitrite (mg/l)	<0.05 - 1.5	<0.01 - 0.15 (as N)	10
Organic carbon, dissolved (mg/l)	nd	0.17 - 80	---
pH (units)	5.9 - 7.8	7.1 - 8.2	6.5 - 9.0
Potassium, dissolved (mg/l)	0.25 - 2.0	1.9 - 4.8	---
Selenium, dissolved (mg/l)	nd	<0.01	0.010
Sodium, dissolved (mg/l)	0.4 - 6.0	9.1 - 57	250
Solids, dissolved (mg/l)	2 - 104	200±	500
Sulfate (mg/l)	0.27 - 4.5	2.5 - 40	200
Suspended Solids (mg/l)	5 - 20	<35 mg/l est.	35 mg/l
Zinc, dissolved mg/l)	<0.02 - 0.04	<0.02 - 0.36	0.030*

nd = no data

*Parameters with potential to equal or exceed standards.

NOTES:

[1] Range of surface runoff quality. Does not include peak discharge quality measurments (ERT 1985a).

[2] Ground water data (ERT 1984e) and leach data (Bookcliffs 1985).

[3] Standard listed is the most stringent for the various protected uses in Alaska. Sources: EPA 1976; McNeely et al. 1979; Sittig 1981; ADEC 1982; ADEC 1984. The receiving water at times equals or exceeds some of these standards now under natural conditions.

[4] From Diamond Alaska Coal Company 1985, Vol. XXI. Note - low flow conditions critical and require additional operational modifications for compliance with turbidity regulations.

of mining activities) major portions of Lone Creek or Stream 2003 flows could be from treated pit drainage. Impacts to water quality would be greatest when nearby pit operations divert baseload ground water from the creeks, leaving the pit return flow as the primary water source. Since pit drainage would be a continuing winter flow, sediment ponds and other treatment processes would be operated to assure unobstructed water flow into and out of the sediment ponds.

Impacts of treated pit drainage to receiving waters would be especially critical since little dilution water would be available in winter. Therefore, in many instances, no real zone of mixing could be defined. During winter baseflow conditions, stream turbidities are very low. Compliance of discharge at low baseflow conditions is not directly projected by the recent studies and modeling (Diamond Alaska Coal Company 1985, Vol. XXI). However, the conservative assumptions used, as well as limitations on discharge rates, proposed double stage flocculation for problem sediment pond systems, and possible use of controlled discharge versus stream baseflow suggests that there is enough flexibility built into the system such that compliance can be achieved.

The specific impacts could be slight increases in normal sediment levels and turbidity and possibly in boron, nickel, iron, manganese, ammonia nitrogen, and zinc concentrations. The proposed treatment methods using flocculants are slightly reduced in efficiency during very cold conditions. Although other treatment methods are not feasible on the scale necessary, use of settling alone to remove suspended solids as well as precipitated metals would limit strict compliance with water quality standards without the proposed operational modifications. Treatment and removal of ammonia nitrogen would not be feasible on such a large scale nor at such low concentrations. The occurrence of metals and ammonia nitrogen in the projected pit drainage flow is based upon baseline data analyses and with present data is not statistically significant as a projection of actual pit drainage quality. In addition, estimated impacts would not be significant compared to baseline conditions.

- Mine Service Area

The mine service area would contain shops, coal transfer points, equipment ready yards, and a small coal storage area. Sources of waste water during operation include site runoff, runoff from coal storage and transfer areas, washdown water from equipment maintenance facilities, and domestic sewage.

Runoff from disturbed areas would be routed through stabilized drainage systems and sediment ponds before being discharged to tributaries of the Chuitna River. Water quality of the coal storage area and coal transfer point runoff could be similar to that of the pit drainage.

No adverse effect on water quality is expected from water use and the disposal of treated sanitary wastes from mine site facilities. Domestic waste will be treated by secondary treatment and discharged into the Chuitna River at the same location as the discharge from the housing complex. The effects of domestic waste discharges on the Chuitna River are discussed in detail in the Housing Facilities section using the total discharge from both treatment plants.

No significant impact would occur from the discharge of treated effluent. However, there may be risks from breaks in the 3.2 km (2 mi) pipeline due to freezing during the winter. This could result in discharge of treated secondary effluent to local drainages. The impact of such a spill would be limited in area and volume and the quality of the effluent would be high. Adverse impacts from such a spill would not be significant.

Wildfires and man-caused fires including slash burning can affect water quality by introducing into water bodies nutrients and suspended solids resulting from erosion in burned areas. Depending on the water body, this may be an adverse or beneficial effect. Fire fighting equipment and techniques also disturb watersheds, causing effects on water quality.

Petroleum product spills into water bodies would adversely affect water quality. A layer of petroleum on the surface of a water body would inhibit aeration of the water, reducing the dissolved oxygen content. Soluble fractions are usually toxic to plant and animal life. The probability of large spills, however, is low because all storage areas would be surrounded by dikes capable of retaining 110 percent of the volume of the petroleum product storage tanks. Additionally, an SPCC plan would be developed to minimize the potential for accidental discharge of refined products and to outline cleanup response if a spill occurred.

Solid wastes generated in the mine area would be landfilled in an approved solid waste disposal site. Permit restrictions would require design of a facility that would protect surface and ground-water quality. Wells would be installed to monitor any adverse effects early so that actions could be taken to correct any water quality impacts.

The solid waste disposal sites would require fencing and periodic covering of deposited wastes to control blowing debris and limit animal problems. Burnables would be incinerated prior to landfill. Sludges would be stabilized as required by state law using one or more of the approved methods prior to inclusion in the landfill.

Reclamation of landfill sites would include covering, contouring for proper drainage, and revegetation. Impacts would be limited to visual, noise, and site disturbances during use. Upon closure, the reclaimed site would be monitored for water quality impacts and reclamation success. A properly constructed, operated, and reclaimed site should limit significant long-term environmental impacts.

Sediment from the sediment ponds would be removed periodically to maintain pond capacity. The sediment would contain classified particles from erosion and pit dewatering activities. The material should represent the general composition of the existing overburden, interburden, and possibly coal site materials. Grain size of pond sediment would likely be smaller than the average site material. However, chemical composition should not be markedly different from a composite sample of the various site materials mixed at different proportions depending upon season and mining activity. The material may not be suitable for use in revegetation or for placement in the top soil zone due to higher than normal concentrations of parameters that could inhibit plant growth or the erosion potential of the smaller grain size distribution. Therefore, if pond sediment is found to be unsuitable, it would be buried under a layer (1.2 m [4 ft] minimum) of suitable erosion-resistant growth material.

The chemical composition of the sediment should be no more concentrated than individual geologic formations unless some natural flotation or gravity separation process is involved. However, the location and absence of weathering of sediments could result in greater reactivity of sediments. Therefore, monitoring will be necessary to fully assess short-term water quality impacts and suitability for use as plant growth media.

5.3.2.4 Biology

Mine Area

Construction, operation, and reclamation of the Diamond Chuitna Mine would result in a progression of changes over more than 30 years in the surface water quality and hydrology of mine area streams, primarily upper portions of Stream 2003. The nature and extent of these changes has been discussed above. Changes in the physical and chemical characteristics of the streams would cause changes in associated biota that would range from extreme and highly predictable (in cases of mining through existing drainages) to subtle and/or highly unpredictable (in adjacent streams such as Lone Creek and in downstream reaches of 2003). A major unknown is the time required to restore aquatic productivity to mined drainages. For the purpose of impact analysis, both the 10-year and 30-year impact scenarios have been considered (Tables 5-10 and 5-11).

At the 10-year point in mine development, 4.3 km (2.67 mi) of smaller tributaries to Stream 2003 would be mined

Table 5-10

AQUATIC HABITAT EVALUATION OF POTENTIALLY AFFECTED REACHES OF MINE AREA STREAMS (YEAR 10)(a)

DRAINAGE	20 CHUITNA R.	2002 LONE CR.	2002 LONE CR.	2002 LONE CR.	2003	2003	2003	2003	2003	2003	2003	2004	2004	2004	2004	TOTALS
TRIBUTARY	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	200304	200305	200306	MAINSTEM	MAINSTEM	MAINSTEM	200403	-
REACH	BELOW 2003	UPPER	MIDDLE	LOWER	UPPER	MIDDLE (upper)	MIDDLE (lower)	LOWER	ENTIRE	ENTIRE	ENTIRE	UPPER	MIDDLE	LOWER	UPPER 360 m	-
AFFECTED LENGTH (meters)	17910	3670	11340	6390	4610	3215	5645	4020	2020	1450	2100	4630	4830	3020	360	76010
MEAN WIDTH (meters)	22.6	2.4	3.7	6.7	1.8	4	4	4.6	1.2	1.2	2.4	2.4	3.3	3.9	1 (i)	
AFFECTED AREA (m2)	404766	8808	41958	42813	8298	12860	22580	18492	3384	1740	5040	11112	15939	11778	360	609928
HOW AFFECTED	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	MINED	MINED	AREA DISTURBANCE	NIL	NIL	NIL	NIL	-
MAX. % HABITAT REDUCTION (b)	2	20	10	5	25	20	15	10	25	100	50	0	0	0	0	-
MAX. PERCENTAGE OF DOCUMENTED SYSTEM ESCAPEMENT USING REACH (c)																
- CHINOOK	31	0	0	7	0	0	7.7	6.3	0	0	0	0	4.6	3.4	0	60
- COHO	50	1.4	7.2	7.4	1	2.3	2.3	2.4	0	1	0	2.6	3.7	2.7	0	84
- PINK	80	0	5	5	1	3	3	3	0	0	0	0	0	0	0	100
MAXIMUM LOSS OF DOCUMENTED SPAWNERS (no.) (d)																
- CHINOOK	37.2	0	0	21	0	0	69.3	37.8	0	0	0	0	0	0	0	165.3
- COHO	25	7	18	9.25	6.25	11.5	8.625	6	0	25	0	0	0	0	0	116.625
- PINK	328	0	102.5	51.25	51.25	123	92.25	61.5	0	0	0	0	0	0	0	809.75
POTENTIAL SPAWNING DENSITY (no./km)																
- CHINOOK	150	10	100	200	10	100	100	150	10	10	10	50	60	100	10	
- COHO	20	20	50	180	30	50	50	50	20	20	20	30	50	50	20	
- PINK	1500	200	600	400	200	600	600	600	100	100	100	0	0	0	0	
MAXIMUM LOSS OF POTENTIAL SPAWNERS (no.)																
- CHINOOK	53.73	7.34	113.4	63.9	11.52	64.3	84.67	60.3	21.15	14.5	10.5	0	0	0	0	505.32
- COHO	7.164	14.68	56.7	57.51	34.57	32.5	42.33	20.1	42.3	29	21	0	0	0	0	357.5165
- PINK	537.3	146.8	680	128	232	386	508	241	211.5	145	105	0	0	0	0	3320
POTENTIAL REARING DENSITY (no./m2)																
- CHINOOK	0.7	0.5	0.7	0.7	0.5	0.7	0.7	2.25	0.5	0.5	0.5	0.5	0.7	0.7	0.5	
- COHO	0.6	2	3.1	1.2	2	2	2	1	2	3	2	2	3	1.2	2	
- RAINBOW/ DOLLY VARDEN	0.5	0.9	0.15	0.3	1	0.15	0.15	1	0.4	0.5	0.4	1.7	0.5	1	0.5	
MAXIMUM LOSS OF POTENTIAL REARING SALMONIDS (no.)																
- CHINOOK	5666.724	880.8	2937.	1498.	1037.	1800.	2370.	4160.	1269	870	1260	0	0	0	0	23751.28
- COHO	4857.192	3523.	13006.	2568.	4149	5144	6774	1849.	5076	5220	5040	0	0	0	0	57208.35
- RAINBOW/ DOLLY VARDEN	4047.66	1585.	629.3	642.1	2074.	385.8	508.0	1849.	1015.	870	1008	0	0	0	0	14615.41

(a) SOURCE: ERT (1984a, 1984b, 1985) FOR STREAM CHARACTERISTICS; SEE TABLE 4-11; POTENTIAL FISH USEAGE IS ESTIMATED USING BASELINE MEASUREMENTS (TABLE 4-11) AND THE ASSUMPTION THAT ACCESS PROBLEMS CREATED BY BEAVER ACTIVITY ARE REMOVED.

(b) REDUCTION ASSUMED TO BE 100% FOR STREAMS TO BE MINED THROUGH. REDUCTION IN HABITAT FOR DOWNSTREAM REACHES WERE ASSIGNED BASED ON COMBINED EFFECTS OF WATER QUALITY AND FLOW CHANGES AT THE HEIGHT OF PROJECT DISTURBANCE FOR THAT REACH.

(c) SEE TABLE 4-10. CHUITNA PERCENTAGES BASED ON ERT 1985 (TABLE 3.8-9); OTHER PERCENTAGES PROPORTIONED ON THE BASIS OF RATIOS OF REACH AREA AFFECTED TO TOTAL AREA OF THE REACH FOR WHICH SPAWNING DATA IS AVAILABLE. PERCENTAGE FOR PINK SALMON IN 2002 AND 2003 ASSUMED TO BE 10 BASED ON LARGE NUMBERS PRESENT IN 1980.

(d) MAXIMUM PERCENTAGE USING THE REACH TIMES THE MAXIMUM PERCENT HABITAT REDUCTION TIMES MAXIMUM DOCUMENTED SYSTEM ESCAPEMENT FROM TABLE 4-10.

(e) BASED ON MAXIMUM OBSERVED SPAWNER DENSITIES IN THE REACH IN QUESTION OR A COMPARABLE REACH IN AN ADJACENT SYSTEM; ASSUMES REMOVAL OF STREAM MIGRATION BARRIERS AND OPTIMUM OCEAN SURVIVAL.

(f) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL SPAWNING DENSITY TIMES REACH AREA (LENGTH).

(g) BASED ON MAXIMUM MEASURED REARING DENSITY (TABLE 4-11) IN THIS OR COMPARABLE REACH; ASSUMES REMOVAL OF ALL BARRIERS TO UPSTREAM MIGRATION.

(h) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL REARING DENSITY TIMES REACH AREA (m2).

Table 5-11

AQUATIC HABITAT EVALUATION OF POTENTIALLY AFFECTED REACHES OF MINE AREA STREAMS (YEAR 30)(a)

DRAINAGE	20 CHUITNA R.	2002 LONE CR.	2002 LONE CR.	2002 LONE CR.	2003	2003	2003	2003	2003	2003	2003	2004	2004	2004	2004	TOTALS
TRIBUTARY	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	200304	200305	200306	MAINSTEM	MAINSTEM	MAINSTEM	200403	-
REACH	BELOW 2003	UPPER	MIDDLE	LOWER	UPPER	MIDDLE (upper)	MIDDLE (lower)	LOWER	ENTIRE	ENTIRE	ENTIRE	UPPER	MIDDLE	LOWER	UPPER 360 m	-
AFFECTED LENGTH (meters)	17910	3670	11340	6390	4610	3215	5645	4020	2820	1450	2100	4630	4830	3020	360	76010
MEAN WIDTH (meters)	22.6	2.4	3.7	6.7	1.8	4	4	4.6	1.2	1.2	2.4	2.4	3.3	3.9	1 (1)	
AFFECTED AREA (m2)	404766	8808	41958	42813	8298	12860	22580	18492	3384	1740	5040	11112	15939	11778	360	609928
HOW AFFECTED	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	MINED	MINED	WQ/FLOW	WQ/FLOW	MINED	MINED	MINED	WQ/FLOW	WQ/FLOW	WQ/FLOW	MINED	-
MAX. % HABITAT REDUCTION (b)	5	40	20	10	100	100	80	25	100	100	100	10	20	15	100	-
MAX. PERCENTAGE OF DOCUMENTED SYSTEM ESCAPEMENT USING REACH (c)																
- CHINOOK	31	0	0	7	0	0	7.7	6.3	0	0	0	0	4.6	3.4	0	60
- COHO	50	1.4	7.2	7.4	1	2.3	2.3	2.4	0	1	0	2.6	3.7	2.7	0	84
- PINK	80	0	5	5	1	3	3	3	0	0	0	0	0	0	0	100
MAXIMUM LOSS OF DOCUMENTED SPAWNERS (no.) (d)																
- CHINOOK	93	0	0	42	0	0	369.6	283.5	0	0	0	0	55.2	30.6	0	873.9
- COHO	62.5	14	36	18.5	25	57.5	46	45	0	25	0	6.5	18.5	10.12	0	364.625
- PINK	820	0	205	102.5	205	615	492	461.2	0	0	0	0	0	0	0	2900.75
POTENTIAL SPAWNING DENSITY (no./km)																
- CHINOOK	150	10	100	200	10	100	100	150	10	10	10	50	60	100	10	
- COHO	20	20	50	180	30	50	50	50	20	20	20	30	50	50	20	
- PINK	1500	200	600	400	200	600	600	600	100	100	100	0	0	0	0	
MAXIMUM LOSS OF POTENTIAL SPAWNERS (no.)																
- CHINOOK	134.325	14.68	226.8	127.8	46.1	321.5	451.6	452.2	28.2	14.5	21	23.15	57.96	45.3	3.6	1968.765
- COHO	17.91	29.36	113.4	115.0	138.3	160.7	225.8	150.7	56.4	29	42	13.89	48.3	22.65	7.2	1170.73
- PINK	1343.25	293.6	1361	256	927	1929	2710	1809	282	145	210	0	0	0	0	11265
POTENTIAL REARING DENSITY (no./m2)																
- CHINOOK	0.7	0.5	0.7	0.7	0.5	0.7	0.7	2.25	0.5	0.5	0.5	0.5	0.7	0.7	0.5	
- COHO	0.6	2	3.1	1.2	2	2	2	1	2	3	2	2	3	1.2	2	
- RAINBOW/ DOLLY VARDEN	0.5	0.9	0.15	0.3	1	0.15	0.15	1	0.4	0.5	0.4	1.7	0.5	1	0.5	
MAXIMUM LOSS OF POTENTIAL REARING SALMONIDS (no.)																
- CHINOOK	14166.81	1761.	5874.	2996.	4169	9002	12644	31205	1692	870	2520	555.6	2231.	1236.	180	91086.24
- COHO	12142.98	7046.	26013	5137.	16596	25720	36128	13869	6768	5220	10080	2222.	9563.	2120.	720	179347.7
- RAINBOW/ DOLLY VARDEN	10119.15	3170.	1258.	1284.	8298	1929	2709.	13869	1353.	870	2016	1809.	1593.	1766.	180	52308

(a) SOURCE: ERT (1984a, 1984b, 1985) FOR STREAM CHARACTERISTICS; SEE TABLE 4-11; POTENTIAL FISH USEAGE IS ESTIMATED USING BASELINE MEASUREMENTS (TABLE 4-11) AND THE ASSUMPTION THAT ACCESS PROBLEMS CREATED BY BEAVER ACTIVITY ARE REMOVED.

(b) REDUCTION ASSUMED TO BE 100% FOR STREAMS TO BE MINED THROUGH. REDUCTION IN HABITAT FOR DOWNSTREAM REACHES WERE ASSIGNED BASED ON COMBINED EFFECTS OF WATER QUALITY AND FLOW CHANGES AT THE HEIGHT OF PROJECT DISTURBANCE FOR THAT REACH.

(c) SEE TABLE 4-10. CHUITNA PERCENTAGES BASED ON ERT 1985 (TABLE 3.8-9); OTHER PERCENTAGES PROPORTIONED ON THE BASIS OF RATIOS OF REACH AREA AFFECTED TO TOTAL AREA OF THE REACH FOR WHICH SPAWNING DATA IS AVAILABLE. PERCENTAGE FOR PINK SALMON IN 2002 AND 2003 ASSUMED TO BE 10 BASED ON LARGE NUMBERS PRESENT IN 1980.

(d) MAXIMUM PERCENTAGE USING THE REACH TIMES THE MAXIMUM PERCENT HABITAT REDUCTION TIMES MAXIMUM DOCUMENTED SYSTEM ESCAPEMENT FROM TABLE 4-10.

(e) BASED ON MAXIMUM OBSERVED SPAWNER DENSITIES IN THE REACH IN QUESTION OR A COMPARABLE REACH IN AN ADJACENT SYSTEM; ASSUMES REMOVAL OF STREAM MIGRATION BARRIERS AND OPTIMUM OCEAN SURVIVAL.

(f) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL SPAWNING DENSITY TIMES REACH AREA (LENGTH).

(g) BASED ON MAXIMUM MEASURED REARING DENSITY (TABLE 4-11) IN THIS OR COMPARABLE REACH; ASSUMES REMOVAL OF ALL BARRIERS TO UPSTREAM MIGRATION.

(h) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL REARING DENSITY TIMES REACH AREA (m2).

through, in various stages of preparation for mining, or occupied by sediment ponds (Table 5-10). Full development of the 30-year mine pit would result in the direct destruction of some 14.6 km (9.1 miles) of stream habitat, mostly (98 percent) in system 2003 (Table 5-11). Measured or extrapolated levels of anadromous fish use (spawning and rearing) of these areas is generally high (Table 4-11).

Available information suggests that downstream impacts due to changes in water quality would be minimal except where sediment pond discharges comprise a major percentage of streamflow. The applicant intends to meet all applicable state and federal water quality standards. Nonetheless, extended periods of above-ambient levels of suspended sediments and turbidity would inevitably result from instream and in-drainage work in the mine area and from sediment retention pond discharges, especially during the winter.

Heavy siltation can smother aquatic invertebrates that comprise roughly one-half or more of the diet of trout and salmon in small streams (Dames & Moore 1976). Loss of interstices among larger gravel and cobbles removes areas of refuge for fry and may increase predation loss to birds or larger fish. Emergence pathways may also be blocked, resulting in delayed emergence or entombment of alevins (Phillips et al. 1975).

Siltation can also reduce fish production by reducing circulation of aerated water through the spawning gravel necessary for survival of eggs and alevins (Mason 1969). High turbidity (e.g., greater than 30 N.T.U.) greatly reduces feeding efficiency (Berg and Northcote 1985). Reduced light penetration of turbid water, if prolonged, may decrease growth of periphyton* on which some fish food organisms subsist. Healthy fish adapted to living in streams which traditionally flood at least once a year protect their gills by secretion of mucus to carry off the irritants. Prolonged exposure of fish to high concentrations of suspended particles with a hardness greater than one may cause damage to the gills and, in extreme cases, lead to death (EIFAC 1965; Cordone and Kelly 1961). The effect of natural siltation in local creeks is minimized by its association with periods of high runoff when stream velocities and turbulance are great enough to prevent significant deposition. Introduction of silt into streams during periods of low flow, when deposition is greatest, has a far more damaging impact on stream biota. Recent work by Berg and Northcote (1985) has shown that even short pulses of turbid water in the 30-60 NTU range reduces not only coho juvenile feeding efficiency but territorial behavior patterns as well.

The planned erosion and water quality control program for construction and operations should reduce sediment introduction during critical low flow periods. Erosion control measures also would reduce inputs during high runoff periods. However, some siltation would be inevitable as a result of work in and near streams, normal sediment retention pond discharges, or overloading of silt collection facilities during heavy rainfall. Some reduction in the abundance of benthic fauna and reduced growth rates of fish would likely result in stream areas near discharge points. Reduced survival of salmonid eggs and alevins in the stream bed gravels could occur downstream of discharge points (e.g., middle and lower 2003) when such sediments remain in spawning gravels during the winter intragravel development period for salmon. Discharges of water containing suspended materials under ice in the winter may be particularly harmful. If water quality standards are met during mine operation, sediment impacts would probably not be significant.

In addition to occasional introduction of above ambient suspended sediment loads, sediment pond discharges may intermittently contain levels of zinc approaching standards required for protection of aquatic life. Toxic effects of many trace metals, including zinc, on aquatic life are known to be highly dependent on water pH, hardness, and (less predictably) temperature (EPA 1972; Hodson and Sprague 1975). Acute toxicity generally increases with decreasing pH (below 7.0) as a result (in part at least) of the increased mobility and bioavailability of metals (EPA 1976). The pH values in surface waters of the study area are slightly basic, generally ranging between 7.5 to 8.5. Increasing hardness (commonly reported as equivalent concentration of calcium carbonate) reduces the toxic effects of divalent metal ions such as copper, lead, zinc, and cadmium (EPA 1976). Hardness in study area waters is typically low, ranging between 10 and 50 mg/l (as $CaCO_3$) with higher values during periods of lower flow and vice versa, thus little reduction in metal toxicity would be expected. Effects of temperature on metal toxicity are more variable with increased or decreased toxicity depending on species, acclimation temperature, exposure temperature, and metals concentration (whether above or below acutely lethal levels) (Hodson and Sprague 1975; Cairns et al. 1975).

Brown (1976) has suggested that fish can tolerate toxic metals up to a given concentration by actively secreting them back into the water (via gills or kidney) or by having them bound to a specific protein (metallothionein). However, once a threshold value is reached, only a slightly higher concentration causes mortality (the "spill-over hypotheses"). Roch et al. (1982), in studies of fish populations in contaminated reaches of the Campbell River system (British Columbia), concluded that metallothionein concentration was a useful measure of the degree of exposure to fish to heavy metals.

Levels of zinc projected for intermittent release from the ponds (0.04 mg/l) approach the EPA 24-hour average criterion for zinc (0.047 mg/l). These levels are all well below the maximum level of 0.534 mg/l shown by Holcombe et al. (1979) to have no effect on survival, growth, or reproduction in brook trout. They are also below the maximum level of 0.112 mg/l shown by Chapman (1978) to have no effect on adult to smolt survival, fertility, fecundity, growth, or saltwater adaptability of sockeye salmon. Exposure to 0.242 mg/l similarly had no effect over the embryo to smolt exposure period for sockeye. Thus, no measureable effects are expected on study area fish due to zinc exposures.

Another possible, but unpredictable, impact on salmon related to water quality concerns the fact that adult salmon identify their home stream by "smelling" the water. The addition of sediment or small concentrations of metallic pollutants would be unlikely to interfere with this ability. However, the transfer of water from one watershed to another, or, as is the case with Stream 2003, the elimination of headwaters could alter water chemistry to a sufficient degree to confuse homing ability. Such confusion could result in spawning occurring in marginal habitat or, at worst, elimination of a tributary as spawning habitat. Water allocation to various streams from the sediment pond and diversion systems would vary with the extent of mine development.

Changes in stream flow downstream of the mine pit on all three streams (Lone Creek, 2003, and 2004) during operation would result in changes in stream habitat for anadromous salmonids. Altered stream flow can have varied impacts on fish habitats depending on the direction and magnitude of the change, the time of year the change occurs, and the nature of fish populations present. ERT (1985c) performed an instream flow incremental methodology (IFIM) on Lone Creek and Stream 2003 for the first 10 years of mine life using the methodology developed by the U.S. Fish and Wildlife Service (Bovee 1982). Their results indicate that for "normal" water years, slightly decreased flows (0.028 m^3/sec [1 cfs] reduction at all stations and times was assumed) would have a variety of effects on fish habitat. During summer and fall, the reduced flows would generally result in reduced habitat for coho juvenile and spawning chinooks while increasing habitat for chinook juveniles. Flow reductions used in these analyses do not reflect the maximum projected over the 30-year project life and do not evaluate the potential impacts during winter, which may be the most critical time period for fish.

Based on available information on the cumulative effects of all of the physical and chemical alterations likely downstream of the mined area, a subjective estimate has been formulated of a likely resultant reduction in fish habitat in these reaches ("maximum percentage habitat reduction") for the 10 year and 30 year scenarios (Tables

5-10 and 5-11). This maximum percentage habitat reduction factor logically can range from 0 percent (no change in habitat) to 100 percent (complete destruction of the stream as it is mined through). Intermediate values are based largely on the maximum reduction in minimum stream flow that would occur when no return flow is provided to the streams from ground water entering the pit. During the summer months, the effects of this unlikely and short term occurrence (e.g., due to pump or power failure) could be readily modelled using the IFIM for selected species and life history stages (Diamond Alaska Coal Company 1985). Such an analysis would likely show changes in habitat for a given flow change that vary in magnitude and direction with species and life history stage. The most damaging summertime scenario would occur if a flow reduction caused drying of redds containing pink or chinook salmon eggs. However, IFIM is not appropriate for modeling changes in habitat that would occur due to the more likely scenario where cold weather causes the water entering the pit to freeze resulting in interception of ground water which normally would be pumped to the streams. Because limited data are available to address this condition and because of its likelihood of occurrence, the predicted winter flow reductions (Table 5-7) have been used as the primary basis for assigning the maximum percent habitat reduction values. These values are considered to be indicative of the relative magnitude of habitat reduction that might be experienced between stream reaches subjected to varying degrees of project-related impacts.

This estimated percentage reduction is used to weigh fish habitat loss estimates and to calculate resultant fish losses. It is assumed that there is a one to one relationship between habitat loss and fish loss. This would occur only if habitat is limiting to the species/life history stage in question, which is unlikely in portions of these streams to which beaver dams appear to limit access. In addition, it would only occur if the flow (i.e., habitat) reduction was prolonged; for example, a few days of lowered flows during the summer might reduce fish growth rates somewhat but would be unlikely to cause significant mortalities. This application is therefore conservative and represents a worst-case scenario.

Because access to many areas of the three mine area tributaries is severely limited by beaver dams (Dames & Moore 1980; Diamond Alaska Coal Company 1985), there is a high degree of variability in numbers of adults using the middle and upper reaches of these streams from year to year. Therefore, combined losses from both direct habitat loss in the pit area and indirect downstream effects have been calculated two ways (Tables 5-10 and 5-11): 1) using maximum documented spawner densities, and 2) using estimated potential maximum densities of both spawners and rearing fish. Calculations using potential maximum densities indicate that at year 10, habitat for 505 chinook, 360 coho, and 3,320 pink adults might be lost, assuming a maximum escapement for each species and assuming that fish encountering this habitat degradation do not successfully spawn elsewhere.

As discussed in the surface hydrology section, the period of maximum hydrological impact would occur in the later years of mining and in the early years of reclamation perhaps occupying years 20 through 30 of mine life. Worst case impacts would apply to this time period. As shown on Table 5-11, at the 30-year point in mine life, habitat for a calculated 1,970 chinook, 1,170 coho, and 11,300 pink salmon spawners might be lost under the worst case assumptions stated above.

Using the maximum documented (c.f. potential) spawning density in a similar calculation (Table 5-10) yields substantially lower adult loss figures: 165 chinook, 115 coho, and 810 pink spawners lost at the 10-year point due to habitat degradation (assuming that fish encountering this lost habitat do not successfully spawn elsewhere). These losses would constitute reductions of 2.8, 4.6 and 4.0 percent, respectively, of the maximum estimated system escapements for chinook, coho, and pink salmon (Table 4-12). At the 30-year point in mine life, a similar calculation gives an estimated habitat loss for 875 chinook, 365 coho, and 2,900 pink salmon spawners (14.6, 14.6 and 14.2 percent, respectively, of the maximum estimated system escapements).

In addition, habitat for 23,750 juvenile chinook, 57,200 juvenile coho, and 14,600 juvenile and adult rainbow and Dolly Varden also could be lost at year 10 (Table 5-10). These losses of juvenile habitat would result in a potential additional loss of some 238 and 571 returning adult chinook and coho salmon, respectively, assuming a 1 percent juvenile-to-adult survival. At the 30-year point in mine life (Table 5-11), habitat losses could affect 91,000 chinook, 179,300 coho, and 52,300 rainbow and Dolly Varden. These losses of juvenile habitat, if realized, could result in the loss of approximately 911 chinook and 1,793 coho adults - a very high percentage of the maximum documented total system escapement.

Obviously, these numbers are highly conservative in that they assume coincident loss of all stream habitats that would be affected by mine operation. They also assume maximum potential values of fish usage. Finally, these loss calculations have assumed the worst case flow reduction factors for each reach based on Table 5-7 which assumes interruption of the normal return flow to the streams from pit dewatering as discussed above. In actuality, there would be a loss of flow, hence productivity, in each creek for some years as the mine pit is progressively excavated and backfilled and the stream is rehabilitated. The degree of success with which streams can be rehabilitated is unknown and would depend on the level of effort expended, the degree to which the existing physical habitat can be reconstructed, and perhaps most importantly, the rate of ground-water recharge. Certainly there would be a long term (e.g., several decades or more) loss of habitat due to the difficulty of reconstructing habitat as good as naturally exists and due to loss of habitat area where highly sinuous stream reaches are replaced by straighter reaches.

Using the habitat value ratings assigned for the several stream reaches in the mine area, the wetted surface area of each reach, and the estimated maximum percent habitat loss (Tables 5-10 and 5-11), the area of habitat lost in each category for each species has been calculated for the 10-year and 30-year mine scenario (Tables 5-12 and 5-13). These calculations show a moderate potential loss after 10 years of 1.21 ha (2.99 ac) of very high quality chinook habitat in the lower reaches of the three tributaries and in the Chuitna River itself (4.02 ha [9.9 ac] after 30 years). Another 1.01 ha (2.5 ac) of high quality chinook habitat would be lost in the middle reaches of the three tributaries after 10 years (4.25 ha [10.50 ac] after 30 years). Very high quality coho habitat (1.02 ha [2.52 ac]) would be lost from the middle reaches of each tributary after 10 years (4.02 ha [9.9 ac] after 30 years) with additional loss of high quality coho habitat in all other area waters. High quality pink spawning habitat (2.43 ha [6.0 ac] and 8.60 ha [21.2 ac] after 10 and 30 years, respectively) would be lost from the mainstream of Lone Creek and 2003 where heavy spawning was noted in 1980.

5.3.3 Impacts to the Marine Environment

There would be no impacts to the marine environment associated with the mine and mine facilities.

5.3.4 Air Quality Impacts

Ambient air quality monitoring data are not available for the project site. Air quality monitoring done in the project region, however, demonstrates that ambient air quality levels are well below the National Ambient Air Quality Standards (NAAQS). Current ambient air quality levels at the project site are therefore expected to be in attainment with the NAAQS (see Section 4.6.2). Since air quality modeling was done for the whole project, the following discussion will cover the mine, mine service area, ports, transportation corridors, and housing sites.

5.3.4.1 Emissions

The project would generate emissions of several pollutants including nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), hydrocarbons (HC), particulate matter

Table 5-12

WEIGHTED MAXIMUM POTENTIAL HABITAT LOSS (HA) BY LOCALLY ASSIGNED CATEGORY, DRAINAGE AND SPECIES (YEAR 10)

		Evaluation Species			
Habitat Value	System	Chinook	Coho	Pink	Rainbow/Dolly Varden
Very High	- Chuitna	0.81	0	0	0
	- 2002	0.21	0.42	0	0
	- 2003	0.18	0.60	0	0
	- 2004	0	0	0	0
High	- Chuitna	0	0.81	0.81	0.81
	- 2002	0.42	0.39	0.63	0.18
	- 2003	0.60	1.07	1.00	0.39
	- 2004	0	0	0	0
Medium	- Chuitna	0	0	0	0
	- 2002	0.18	0	0.18	0.63
	- 2003	0.42	0	0	1.28
	- 2004	0	0	0	0
Low	- Chuitna	0	0	0	0
	- 2002	0	0	0	0
	- 2003	0.46	0	0.68	0
	- 2004	0	0	0	0
Total Potential Loss					
	- Very High	1.21	1.02	0	0
	- High	1.02	2.27	2.43	1.38
	- Medium	0.60	0	0.18	1.91
	- Low	0.46	0	0.68	0

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[1] This area is the sum of the products of area and maximum habitat reduction (Table 5-11) for each reach with the habitat value in question.

Table 5-13

WEIGHTED MAXIMUM POTENTIAL HABITAT LOSS (HA) BY LOCALLY ASSIGNED CATEGORY, DRAINAGE AND SPECIES (YEAR 30)

		Evaluation Species			
Habitat Value	System	Chinook	Coho	Pink	Rainbow/Dolly Varden
Very High	- Chuitna	2.02	0	0	0
	- 2002	0.43	0.84	0	0
	- 2003	1.39	3.09	0	0
	- 2004	0.18	0.04	0	0
High	- Chuitna	0	2.02	2.02	2.02
	- 2002	0.84	0.78	1.27	0.35
	- 2003	3.09	3.23	5.31	2.22
	- 2004	0.32	0.32	0	0.39
Medium	- Chuitna	0	0	0	0
	- 2002	0.35	0	0.35	1.27
	- 2003	0.51	0	0	4.11
	- 2004	0.15	0	0	0.35
Low	- Chuitna	0	0	0	0
	- 2002	0	0	0	0
	- 2003	1.33	0	1.02	0
	- 2004	0	0	0.64	0
Total Potential Loss					
	- Very High	4.02	3.97	0	0
	- High	4.25	6.36	8.60	4.88
	- Medium	1.01	0	0.35	5.73
	- Low	1.33	0	1.66	0

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[1] This area is the sum of the products of area and maximum habitat reduction (Table 5-12) for each reach with the habitat value in question.

(PM), and lead (Pb). Any project, before it can be permitted, must demonstrate the ability to comply with the NAAQS for these pollutants. All projects must also show compliance with the Prevention of Significant Air Quality Deterioration (PSD) increments for SO_2 and PM (stationary sources only).

Due to the large amount of particulates associated with mining projects, particulate emissions are of special concern. Air quality impact analyses have been performed to quantify the PM and SO_2 impacts associated with the project (TRC Environmental Consultants 1986, 1987a, 1987b). An analysis of air emissions (assuming that full production would be reached after 4 years) showed that the third and fourth years of coal production would have the largest emissions of particulate matter, the pollutant of greatest concern (TRC Environmental Consultants 1987b). Delayed phase-up to full production would mitigate air quality impacts somewhat because higher coal production levels would occur during later years of the project when the amounts of overburden to be removed would be less. However, this mitigating effect would not be expected to be substantial and largest emissions would still occur in the third and fourth years.

Production phase emissions sources would include those which produce particulate matter only and those which produce gaseous pollutants (NO_x, SO_2, CO, PM, and THC). Particulates sources would include coal and overburden handling activities and vehicle travel over unpaved roads. Gaseous pollutant sources would include bulldozer, ship, and other vehicle tailpipe emissions and slash burning. Annual emissions from all significant sources of particulate matter are shown in Table 5-14. The estimates are called intermediate production and full production, corresponding to the third and fourth years of production, and represent maximum emissions and impacts. Annual gaseous pollutant emissions are presented in Table 5-15. Short-term particulate emissions for full production and production year 3 are presented in Tables 5-16 and 5-17, respectively. Calculations of all emissions plus discussions of potential but insignificant air emissions sources are given in Appendix E. Where feasible, emissions were assigned to one of the four functional areas of the project: the mine area, the mine services area, the port facility, or the housing facility. Emissions which do not occur in one of the four functional areas, such as overland conveyor emissions or miscellaneous vehicle emissions, are classed under general project area emissions.

Slash burning emissions would require a separate permit. It was the applicant's initial plan to bury the slash material in the backfill areas of the pit. However, other

Table 5-14

PRODUCTION-PHASE ANNUAL PARTICULATE EMISSIONS

Source	Intermediate Production Emissions (ton/yr)	Full Production Emissions (ton/yr)
Mine Area:		
Land clearing/reclamation	55.5	55.5
Overburden removal - truck shovel	0.1	0.1
Overburden removal - dragline	165.0	221.4
Overburden hauling	225.6	62.9
Overburden dumping	0.1	0.1
Coal removal	6.3	12.6
Coal hauling	43.6	87.3
Coal dumping	0.0	0.0
Coal primary crushing	0.6	1.2
Wind erosion	38.0	35.9
Haul road maintenance/graders	15.6	15.6
Mine area combustion sources(a)	35.0	30.4
Mine Area Subtotal:	585.4	523.0
Mine Service Area:		
Secondary coal crushing	1.8	3.6
Coal screening	3.0	6.0
Coal handling	0.0	0.0
Coal stockpile	20.5	20.5
Wind erosion	10.0	10.0
Mine Service Area Subtotal:	35.3	40.1
Port Area:		
Coal handling	0.0	0.0
Coal stockpile	218.1	218.1
Wind erosion	11.9	11.9
Port area combustion sources	6.6	6.6
Port Area Subtotal:	236.6	236.6
Housing Area:		
Housing area combustion sources(a)	7.7	7.7
Housing Area Subtotal:	7.7	7.7
General Project Area:		
Overland conveyor	8.4	8.4
Miscellaneous vehicle traffic	9.1	9.1
General Project Area Subtotal:	17.5	17.5
TOTAL	882.5	824.9

Note: Emission rates listed as 0.0 are less than 0.05 tons per year.

(a)Further delineated in Table 5-15.

Table 5-15

GASEOUS AND PARTICULATE ANNUAL COMBUSTION EMISSIONS

Source	Annual Emissions (tons per year)				
	NO_x	SO_2	CO	VOC	PM
Mine Area					
Slash burning	4.8	0.0	167.9	28.9	20.4
Haul trucks	96.3(172.8)[b]	10.5(19.1)	27.0(48.1)	4.3(8.0)	5.9(10.5)
Dozers	92.8	7.8	40.0	4.3	3.7
Graders	4.3	0.5	0.9	0.2	0.4
Fuel Storage	—	—	—	3.0	—
Mine Area Subtotal	198.2(274.7)	18.8(27.4)	235.8(256.9)	40.7(44.4)	30.4(35.0)
Port Area					
Ships	15.0	95.1	2.1	0.2	6.6
Fuel Storage	—	—	—	11.1	—
Housing Facility					
Incinerator	3.3	2.7	11.0	3.3	7.7
General Project Area					
Miscellaneous vehicles	0.1	0.0	0.7	0.1	0.0
Total	216.6 (293.3)	216.6 (225.2)	249.6 (270.7)	55.4 (59.1)	44.7 (49.3)

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[a] Haul truck emissions include overburden and coal handling.

[b] Numbers in parentheses reflect emissions for production year 3 where these differ from full production emissions.

Table 5-16

FULL PRODUCTION SHORT-TERM PARTICULATE EMISSIONS

Source	Full Production Emissions (lb/hr)
Mine Area:	
Land clearing/reclamation	13.7[a]
Overburden removal - truck shovel	0.0
Overburden removal - dragline	50.6
Overburden hauling	14.4[b]
Overburden dumping	0.0
Coal removal	2.9
Coal hauling	19.9[b]
Coal dumping	0.0
Coal primary crushing	0.3
Wind erosion	8.2
Haul road maintenance/graders	5.1[c]
Mine area combustion sources	2.2(1.3)[d]
Mine Area Subtotal:	117.3(116.4)
Mine Service Area:	
Secondary coal crushing	0.4
Coal screening	0.7
Coal handling	0.0
Coal stockpile	4.7
Wind erosion	2.3
Mine Service Area Subtotal:	8.1
Port Area:	
Coal handling	0.0
Coal stockpile	49.3
Wind erosion	2.7
Port area combustion sources	3.5[d]
Port Area Subtotal:	56.0
Housing Area:	
Housing area combustion sources	3.5[d]
Housing Area Subtotal:	3.5
General Project Area:	
Overland conveyor	2.1
Miscellaneous vehicle traffic	2.1
General Project Area Subtotal:	4.2
TOTAL	189.1(188.2)[e]

Note: Emission rates listed as 0.0 are less than 0.05 tons per year.

(a) Based on 338 days per year versus 365 days per year.

(b) Based on an AP-42 average silt loading of 40.8 g/m^2 versus an erroneous ADEC factor of 10.6 g/m^2.

(c) Based on 50 percent control for watering instead of 85 percent control for chemical application.

(d) Only haul truck combustion source emissions were included in the modeling. Emissions are based on annual emissions as given in Table 5-15. Note that slash burning emissions were not included in the short-term emissions, as slash burning would not occur simultaneously with the majority of the mine area emissions.

(e) These were emissions used in particulate air dispersion modeling.

Table 5-17

PRODUCTION YEAR 3 SHORT-TERM PARTICULATE EMISSIONS

Source	Production Year 3 Emissions (lb/hr)
Mine Area:	
Land clearing/reclamation	13.7(a)
Overburden removal - truck shovel	0.0
Overburden removal - dragline	37.7
Overburden hauling	51.5(b)
Overburden dumping	0.0
Coal removal	1.4
Coal hauling	10.0(b)
Coal dumping	0.0
Coal primary crushing	0.1
Wind erosion	8.7
Haul road maintenance/graders	5.1(c)
Mine area combustion sources	3.3
Mine Area Subtotal:	131.5
Mine Service Area:	
Secondary coal crushing	0.4
Coal screening	0.7
Coal handling	0.0
Coal stockpile	4.7
Wind erosion	2.3
Mine Service Area Subtotal:	8.1
Port Area:	
Coal handling	0.0
Coal stockpile	49.8
Wind erosion	2.7
Port area combustion sources	3.5
Port Area Subtotal:	56.0
Housing Area:	
Housing area combustion sources	3.5
Housing Area Subtotal:	3.5
General Project Area:	
Overland conveyor	2.1
Miscellaneous vehicle traffic	2.1
General Project Area Subtotal:	4.2
TOTAL	203.3

Note: Emission rates listed as 0.0 are less than 0.05 tons per year.

(a) Based on 338 days per year versus 365 days per year.

(b) Based on an AP-42 average silt loading of 40.8 g/m^2 versus an erroneous ADEC factor of 10.6 g/m^2.

(c) Based on 50 percent control for watering instead of 85 percent control for chemical application.

Alaska State agencies have expressed concerns regarding bark beetle populations in the slash materials and have requested burning as a disposal method.

Production phase emissions given in Tables 5-14 and 5-15 are subject to both the NAAQS and PSD increments. In addition to the production phase emissions from the project, there would be construction and other temporary emissions. The construction emissions would consist of land clearing and slash burning emissions and would occur during the first three years of the project. The temporary emissions would consist of the emissions from overland truck coal haul during the first two years of coal production before the overland conveyor is constructed. These construction and temporary sources must comply with the NAAQS, but are exempt from the PSD increments. These construction and temporary sources would primarily emit particulates. Particulate emissions associated with these sources are given in Table 5-18.

The final category of emissions associated with the project are the secondary emissions from power generation. A nearby utility would provide generation capacity to accommodate the Diamond Chuitna project. Diamond Chuitna's needs for this project would be approximately 33 megawatts on an annual average basis, while peak demand would be up to 55 megawatts. Table 5-19 shows typical peak hourly and annual average air emissions associated with this demand. These emissions are calculated assuming one 30 MW turbine for average demand and two 30 MW turbines operating to meet peak demand.

The major air emission control measures currently proposed for the project include the application of water and dust control chemicals to the haul roads, installing baghouse devices on the crushers, hooding of the overland conveyor, application of water, as needed, to the stockpiles, and compaction of the unused portions of the stockpiles. Air emission controls for specific activities are given in more detail in Appendix E.

5.3.4.2 Air Dispersion Modeling Results

Air dispersion modeling (TRC Environmental Consultants 1986, 1987a, 1987b, 1988) was performed to determine the short-term and long-term impacts of production phase particulate emissions on ambient air quality. The Industrial Source Complex (ISC) model was used for this analysis. It is an EPA-approved air quality dispersion model. The emission sources were grouped according to location as follows:

Table 5-18

CONSTRUCTION AND TEMPORARY EMISSIONS

Source	Annual Emissions (tons per year) NO_x	SO_2	CO	VOC	PM
Construction					
Land Clearing					
-Fugitive Dust	--	--	--	--	61.6
-Tailpipe Exhaust	103.0	8.6	44.3	4.7	4.1
Slash Burning	4.8	0.0	167.6	28.8	20.4
Total Construction	107.8	8.6	211.9	33.5	86.1
Temporary					
Overland Truck Coal Haul					
-Fugitive Dust	--	--	--	--	343.0
-Tailpipe Exhaust	220.3	24.0	61.6	10.0	13.6
Total Temporary	220.3	24.0	61.6	10.0	356.6

Table 5-19

POTENTIAL TURBINE EMISSIONS ASSOCIATED WITH POWER GENERATION FOR THE DIAMOND CHUITNA PROJECT

Pollutant	Gas Firing Peak Hourly (lb/hr)	Annual Average (tpy)
NO_x	165.1	723
SO_2	negligible	negligible
PM	5.7	25.0
VOC	1.7	7.6
CO	11.1	48.6

- pit sources: those located in the area where the mining and overburden removal operations are ongoing
- mine area haul roads: including the haul trucks, other vehicles, and graders
- mine facilities area: including crushers, conveyors, and the mine stockpile
- overland conveyor
- port area: including the port conveyor operations, the port stockpile, and the ships

Table 5-20 shows the modeled particulate matter impacts for the intermediate and full production years. Based on air dispersion modeling results, the project is in compliance with the previous TSP and new PM_{10} ambient standards, as well as the PSD increments for TSP and the project is in conformance with the Alaska State Implementation Plan.

The ISC model was also used to determine the impact of overland truck haul emissions on ambient air quality. Peak 24-hour average concentrations for these temporary construction emissions were approximately 57 micrograms per cubic meter. This concentration, even if added to a conservative background concentration of 50 micrograms per cubic meter, is still well below the previous 150 microgram per cubic meter TSP and the new PM_{10} ambient standards. As the overland truck haul emissions are a temporary source, PSD increments would not apply.

The only other pollutant of significant concern for this project is sulfur dioxide (SO_2) which is emitted from oil combustion in the ship boilers during "hoteling" operations in port. Table 5-21 shows the SO_2 impacts associated with coal ship operations at the port. Peak predicted concentrations for 3-hour and 24-hour averaging periods were 122 ug/m^3 and 21 ug/m^3, respectively. The values are well below the applicable 3-hour and 24-hour sulfur dioxide PSD increments of 512 ug/m^3 and 91 ug/m^3, respectively. Carbon monoxide and nitrogen oxides were not modeled to determine air quality impacts.

The impacts of the nearby power plant expansion would be addressed in a separate air permit application. It is not expected that there would be a significant cumulative air quality impact from these two projects.

5.3.4.3 Visibility

A level 1 visibility screening analysis (see Appendix E) showed that there will be no visibility impacts from the project on any Class I area.

Table 5-20

AIR QUALITY MODELING ANALYSIS
TOTAL SUSPENDED PARTICULATE (TSP) CONCENTRATIONS

Production Phase/Averaging Period	Modeled TSP Concentration (ug/m^3)	Background TSP Concentration (ug/m^3)	Total TSP Concentration (ug/m^3)	PM10(a) Ambient Standard (ug/m^3)	TSP(b) PSD Increment (ug/m^3)
Intermediate Production					
24-hour	34.5	50.0(c)	84.5	150	37
Annual	3.5(e)	9.0(d)	12.5	50	19
Full Production					
24-hour	36.8	50.0(c)	86.8	150	37
Annual	3.5(e)	9.0(d)	12.5	50	19

(a) The total concentration should be compared with the ambient standards for PM10, since PM10 concentrations will always be less than or equal to the TSP concentrations.

(b) The modeled TSP concentrations should be compared with the PSD increments.

(c) Second highest value observed at Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981 to May 31, 1982 (Radian 1982).

(d) Average TSP concentration observed at Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981 to May 31, 1982.

(e) Annual impacts based on air quality impact analysis prepared by TRC Environmental Consultants, December 11, 1986 and submitted to the Alaska Department of Environmental Conservation. These correspond to particulate matter emissions of 527.8 tons per year at the mine and mine services area and 87.3 tons per year at the port area.

Table 5-21

AIR QUALITY MODELING ANALYSIS
SULFUR DIOXIDE CONCENTRATIONS

Averaging Period	Peak Project Concentration (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	Ambient Standard (ug/m^3)
3-hour	122	35.0(b)	157.0	1300
24-hour	21	7.0(b)	28.0	365
Annual	NA(a)	0.3(b)	ND(d)	80

(a) Not available.

(b) Second highest value observed at Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981, to May 31, 1982, (Radian 1982).

(c) Annual average geometric mean concentration recorded at the Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981, to May 31, 1982, (Radian 1982).

(d) Not determined.

5.3.4.4 Summary

In summary, during project construction, operation and reclamation, maximum predicted short- and long-term concentrations of particulate matter and sulfur dioxide, when added to background levels or compared to PSD increments, would not exceed any state or federal ambient air quality standards in the Kenai, Anchorage, or Tyonek areas or within the undeveloped area outside of Diamond Chuitna Project lease areas. Based on the modeled emissions, it is not anticipated that any short- or long-term ozone, carbon monoxide, or nitrogen oxide ambient air quality standards would be exceeded as a result of this project.

It should be noted that this analysis has addressed major air quality issues and concerns. Particulate matter dispersion modeling and air emissions control technology aspects and concerns will be further addressed in an application for a permit to operate from the Alaska Department of Environmental Conservation.

5.3.5 Noise Impacts

The Diamond Chuitna Coal Project would be located in a relatively isolated area. Typical natural noise levels in areas similar to the Beluga region range from 15 to 45 dB(A), which is considered quiet. Natural noise levels up to 65 dB(A) may be associated with storms and wildlife activities. Coastal areas would have higher noise levels due to strong winds and wave and ice movements.

The mine site would be one of the two areas with the highest noise levels during project operations. Major noise sources in the mine area would include infrequent blasting, bulldozers, front-end loaders, draglines, haul trucks, and crushing equipment. Table 5-22 shows typical noise levels associated with mining equipment. Blasting sound pressure levels are normally thought of as relatively loud noises. However, blasting noise propagates in lower frequencies somewhat like a thunderclap. Low frequency sound of this type would usually be tolerable since it would occur infrequently. The other mine site sound sources would probably combine to a sound level of 100 dB(A) at 15 m (50 ft).

Human receptors in the project vicinity would include project workers and occasional recreational or subsistence hunters and fishermen. The village of Tyonek would be a minimum of 14.4 km (9 mi) from the mine site and it is unlikely that project-generated noise (except possibly occasional blasting) would be audible to Tyonek residents. Noise-related impacts to wildlife are discussed in Section 5.3.1.5.

Table 5-22

ESTIMATED SOUND LEVELS GENERATED BY MINE AREA EQUIPMENT AND FACILITIES

Sound Source	Sound Pressure Level[1] dB(A)
Blasting	170 @ 91 m (300 ft)
Bulldozers	87 @ 15 m (50 ft)
Front-end Loaders	90 @ 15 m (50 ft)
Haul Trucks	90 @ 15 m (50 ft)
Primary/Secondary Crushers	95 @ 15 m (50 ft)
Utility Vehicles	80 @ 15 m (50 ft)
Aircraft Operations	95 @ 15 m (50 ft)
Conveyor	78 @ 10 m (33 ft)
For Comparison:	
OSHA Regulation (15 min. exposure)	115 (max. allowable)
Jackhammer	95 @ 15 m (50 ft)
OSHA Regulation (8 hr. exposure)	90 @ ear
Automobile (100 km/hr [62 mi/hr])	71 @ 15 m (50 ft)
Typical Outdoor Noise (wind, rain, birds)	40 @ 15 m (50 ft)
Soft Whisper	35 @ 2 m (6 ft)

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[1] The sound pressure level in decibels (Db) corresponding to a sound pressure (P) is compared to a reference level of 20 micropascals. Sound pressures for various frequencies of noise are weighted by factors (A weights) which account for the response of the human ear. The sound pressure level is dB(A) = 20 Log10 (P/20).

5.3.6 Socioeconomic Impacts

5.3.6.1 Anchorage and Central Kenai Peninsula

Socioeconomic impacts in Anchorage and the Central Kenai Peninsula would arise due to employment and income generated by the project. The project development schedule calls for a three-year construction period. Construction would begin in the spring with the workforce expected to peak at 1,300 workers by approximately October of the second year (Fig. 2-15). Once the peak of construction is past, employment at the site would decline for the remaining year of construction, then climb during mine operation over a four-year period from about 514 to 848 during the first year of full-scale operation. Air transportation to the site would be provided by the applicant from Anchorage and Kenai.

The primary skills required during construction would be equipment operators, laborers, and various structural construction trades. Mine operation would require primarily equipment operators, mechanics, electricians, plumbers, administrative personnel, and service workers for the worker housing facilities. These skills are in plentiful supply in the available labor force in Anchorage and the Kenai Peninsula Borough. The applicant plans to hire as much of the construction and operation labor force locally as possible, with the possible exception of several specialized equipment operators since persons with these skills are rare in Alaska.

At full production, all of the project alternatives would employ the same number of people. Therefore, socioeconomic impacts in Anchorage and the Central Kenai Peninsula, described below, apply to all action alternatives under the full production scenario.

A recent Kenai Peninsula Borough survey indicated that about 80 percent of the oil and gas employees working the Upper Cook Inlet fields live in the Kenai Peninsula Borough and the remainder live in Anchorage (McIlhargy 1985). However, company-sponsored transportation of these workers to Cook Inlet work sites, is provided only from Kenai. The applicant's local hire policy and probable provision of transportation from both Anchorage and Kenai would likely result in a higher proportion of worker residence in Anchorage. A 50-50 distribution of worker residence between Anchorage and the Kenai Peninsula Borough during both mine construction and operation is assumed for purposes of this analysis.

Impacts on Anchorage

Relative to Anchorage's 116,442 jobs in 1984, the estimated direct increase of approximately 650 jobs during the construction period and 424 jobs during full-scale mine operation would cause proportionally small but beneficial impacts to Anchorage's socioeconomy. Impacts on Anchorage's population would be correspondingly beneficial, but not noticeable given the level of baseline socioeconomic activity in Anchorage.

Impacts on the Central Kenai Peninsula

The effect of the 650 construction and 424 mine operation jobs would be more noticeable in the Central Kenai Peninsula (CKP) than in Anchorage. The most noticeable impacts would be those occurring due to mine operation. Operation-phase impacts are discussed below followed by a summary of construction impacts.

Mine Operation

Although the project's entire operation work force requirement would be directly filled by the locally-available labor supply, indirect impacts could occur. A common experience in Alaska, as in other areas where substantial new employment has been created, is an influx of persons seeking work. If this occurs, the impact of the project could be to substantially increase employment in the CKP, but not to noticeably change unemployment rates. To place a reasonable maximum limit on population growth due to the project, the following analysis assumes that immigration would occur in proportion to the employment increase. The actual impact of the project would probably be lower, particularly if state-wide efforts to discourage potential migrants without jobs from moving to the state are successful.

As the mine's employees spend their paychecks on local goods and services, employment in the service sectors of the CKP economy would increase. Thus, the ultimate increase in employment would be a multiple of the direct increase of 424 operation-phase jobs for local workers generated at the mine itself. Based on analysis of the Soldotna and Kenai Census Areas' place-of-work employment distribution by economic sector (Miller 1985), there are approximately 0.5 service-sector jobs for every job that brings income into the region. Therefore, the 424 jobs taken at the mine by CKP residents can be expected to produce a total increment of about 640 jobs. Most of the 216 service-sector jobs would be located in the City of Kenai, the area's main center of employment.

The spread of knowledge of substantial new employment in the Borough could attract job-seekers, some of whom may compete with Borough residents for jobs both at the mine and at other CKP businesses. If this occurs, a high-side population increase attributable to the project, including the effects of the employment multiplier, can be estimated as equiproportional to the increase in employment, or about 4 percent in the CKP and up to 17 percent in Kenai if all service-sector jobs and immigrants locate in the City (and bring families approximately equal in size to the area's existing families).

Because any inmigrating job-seekers could be expected to live in both Kenai and the surrounding area and some of the 215 new jobs would also be located outside of Kenai, a more reasonable estimated increase to the City's population would be approximately 10 percent by full mine operation. Thus, the maximum population increase to the City of Kenai is estimated at 900 persons. For the CKP, the corresponding population increase would be 1,600 (including the 900-person increase to the City of Kenai). The proportional increase would decline over time as the local socioeconomy grows due to other economic developments.

The population increases described above could have some impact on city planning but should not unduly strain public services and facilities available in the City of Kenai. The City has adequate excess capacity in its public facilities and services to accommodate a current increase in demand of 10 percent. Given the minimum of two years required after the start of construction before appreciable population increases are likely to be felt and the gradual increase in mine operations scale thereafter, there would be adequate time for the City to plan for any service improvement programs that may be required.

If a student-to-population ratio of one-third (the approximate 1985 local average) applies to the 900 persons expected to move to Kenai due to mine operation up to 300 students would be added to the Kenai schools. Several new schools are being completed in the Kenai area and it is expected that an increase in students due to the mine project could be accommodated.

The population increase attributable to the project (up to 1,600 persons) would also increase demand for health services. If a requirement of 5 beds per 1000 population (Nichols 1985) applies, 8 new beds would be required at Central Peninsula General Hospital in Soldotna.

The existing capacity of Kenai's water system is adequate to service demand well into the 1990s. If water demand growth is equal to annual projected without-project population growth of 5 percent, peak daily demand in 1992 will be 1.7 million gallons per day (mgd). If the current per capita peak daily demand of 343 gallons per day applies to the 900-person population impact of mine operation on Kenai, the peak water demand increase would be about 310,000 gallons per day. The total peak demand of 2.0 mgd would be well below the system's current pumping capacity of 2.9 mgd.

Kenai's sewage treatment system, however, will require capacity improvements by the early 1990s without the project. The population increase attributable to mine operation will require system improvement about two years earlier.

Kenai's police and fire protection services may also require improvement due to mine operation. At the 1985 population-to-officer ratio of 475:1, the population increase of 900 would require two new positions in the police department. Fire protection capacity may also require upgrading to serve the 20 percent project-related population increase. The type of capacity improvement would depend upon the location of the increased population and the type of housing and commercial facilities built in response to the increased population.

The maximum population increases to the remaining communities in the CKP would average under 3 percent by full production and would also be gradual over the operations phase-in period. The small population increase occurring over time would not be expected to strain public facilities and services in this larger area.

Mine Construction

Project construction would cause short-term increases similar to, but probably of much lower magnitude than, those described above for mine operation. Although the direct increase to the employed work force in the CKP would be higher (at about 650) than during operation, the short peak construction period would likely limit induced service-sector employment to a negligible level. Furthermore, the short peak period would probably lower the level of inmigration by persons who may move to the area to attempt to obtain construction jobs.

5.3.6.2 Tyonek

For purposes of analysis, the potential socioeconomic effects on the village of Tyonek are classified into three categories: 1) effects on local employment, 2) effects on community population and infrastructure including cumulative socioeconomic effects, and 3) social and cultural effects.

Effect on Local Employment

Unemployment and underemployment are chronic problems for residents of rural Alaskan villages and Tyonek is no exception. A lack of a basic year-round industry is the most pervasive reason for this economic problem. This absence of a solid economic foundation is often compounded by other problems when jobs do become available. For example, unskilled local labor, work schedules incompatible with subsistence and other traditional activities, lack of effective training programs, and cultural differences between Native workers and (usually) white employers contribute to the low levels of local employment in many Alaskan villages. Even in rural areas where industrial or natural resource development has occurred, employment of local residents frequently falls short of expectations. Low employment levels of Tyonek residents at the KLM timber harvesting operation and chip mill in the late 1970s provide an illustration of this problem. This case example is used to show that large-scale resource development projects are not necessarily a panacea to local unemployment problems and that the barriers preventing expanded employment opportunities for rural residents are substantial and must be approached with creative planning and implementation measures by all parties.

Table 2-3 presented projected employment levels associated with the Diamond Chuitna Coal Project. These employment figures refer to mining-phase employment only and do not include employment levels for project construction. Of the projected 848 permanent employees, approximately 218 would be heavy equipment operators, 125 would be light equipment and truck operators, 289 would be mechanics and skilled maintenance personnel, 110 would be involved in life support services (such as cooks), and 106 would be in administrative positions (Table 5-23). Table 5-23 also presents the skills present in Tyonek's current labor force. These skills match, to a considerable degree, the skills required by Diamond Alaska for operation of the coal mine. The potential will therefore exist for Diamond Alaska to use workers from Tyonek in a variety of capacities in both construction and operation of the mine and related facilities. Hence, the coal project has the potential to alleviate Tyonek's local unemployment problem.

In summary, the Diamond Alaska Coal Project would boost local employment opportunities but in the long term would not necessarily solve the unemployment problem in Tyonek. The success of the effort to maintain a high level of local employment would depend on the effectiveness of job training programs, the individual performance of Tyonek workers, Tyonek residents' adaptation to coal mining jobs, successful integration of mine employment with subsistence activities and agreements between Diamond Alaska and the village of Tyonek.

Effects on Community Population and Infrastructure

Because Diamond Alaska plans to house workers in a "single status" housing facility, short-term impacts on Tyonek's population level, infrastructure, and community services would be minimized. Worker needs, such as food, waste disposal, indoor recreation, and others would be provided by the applicant at the housing facility. Impacts on community population and infrastructure for other communities, such as Kenai and Anchorage, were discussed earlier.

Table 5-23

MINING PHASE EMPLOYMENT BY OCCUPATIONAL GROUP

Occupational Group	Mine Employees[1]	Number in Tyonek[2]
Heavy Equipment Operators	218	12
Light Equipment and Truck Operators	125	25
Mechanics and Skilled Maintenance	289	13
Life Support Personnel (e.g., cooks, house-keepers, etc.)	110	undetermined
Administrative	106	13
Total	848	

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[1] Diamond Alaska Coal Company

[2] Based on a 1983 survey by Darbyshire and Associates (1984) that identified a total Tyonek work force of 145 people. These figures include the number of people indicating skill in each general occupational group.

Tyonek's population remained relatively stable throughout the 1970s due, in part, to migration out of the village (see Section 4.7.2.1). One reason for this trend is the lack of local employment opportunities. If the coal project employs a high number of Tyonek residents, then villagers may be less likely to leave the community to seek work. In addition, former Tyonek residents may return to the village to take advantage of increased employment opportunities. Although the population increase due to decreased out-migration or past residents returning to the village would place additional demands on local infrastructure and services (i.e., the school, medical services, and other community facilities), these people would be absorbed relatively easily by the community and assimilated into the social fabric because of familiarity and strong kinship ties with Tyonek. This would not be the case, however, if there were an influx of people unfamiliar with the village, its residents, and the local culture.

Even though the proposed project has been designed to minimize the number of permanent residents and demand for community services on the west side of Cook Inlet, long-term population growth in the area seems inevitable. Although the proposed coal project would not be the sole cause of such growth, it would likely be a major contributing factor (i.e., 1,300 workers in the area by year two of the project would be a major source of demographic change). Additional permanent residents could come from two sources. First, the stimulation of the local economy would provide opportunities for secondary economic expansion and entrepreneurial activity and would make the area more attractive to potential residents. This trend is already occurring at Beluga where a grocery has opened to meet the needs of a growing community and at Granite Point where a local business provides lodging accommodations and a restaurant.

Second, mine workers facing a long-term employment future could decide to purchase private land in Beluga or at Granite Point and move their families to the area. Lands designated for settlement near Congahbuna and Viapan lakes have been identified in the Susitna Area Plan (ADNR 1984). If demand for homesites in the area increases, these lands could be made available for settlement.

The impacts of long-term regional population growth could include increased demand for community services, including pressure to enroll children in the KPB school in Tyonek, increased pressure for a year-round road connection to Anchorage, and erosion of the "quality of life" in Tyonek and gradual dilution of Tanaina culture as more and more non-Tyoneks reside in the area.

Social and Cultural Effects

Sociocultural impacts are difficult to accurately predict for two reasons. First, the effects tend to be caused by the project in its entirety, including cumulative effects, rather than by discrete components. Hence, causal relationships between a given project and a resulting social or cultural effect are extremely difficult to identify. Second, social and cultural impacts are determined as much by the values and attitudes of the affected population as by design of the proposed project. The response capacity or adaptive ability of small, rural communities is typically low because of the magnitude of resource development projects relative to the size of the community, the lack of an effective voice in decisions regarding development of nearby lands, and the rapid rate of change that these communities are already experiencing.

The social and cultural effects of the proposed project would "largely depend upon the question of whether the changes will allow greater opportunities to realize ... values and goals or whether they will constrain and restrict the realization of these" values and goals (Braund and Behnke 1980). The cultural impacts would also depend on the ability of Tyonek residents to effectively adapt to changing socioeconomic conditions.

Four major issues or current concerns emerged during discussions in Tyonek. These issues can be viewed as articulations or relevant aspects of Tyonek's value system and include:

- A need for expanded local employment opportunities
- Increased voice in, and control over, decisions that affect the quality of life in the village and the lands and resources used by village residents
- Maintenance of the rural village quality of life traditionally important to local residents
- Maintenance of a subsistence-based livelihood and protection of the wildlife and environment that provide for these subsistence pursuits

These four issues and their relationship to the proposed project are discussed below.

The project has the potential to provide considerable employment opportunities for Tyonek residents and hence alleviate a major problem in the community. The project may also have positive social effects stimulated by the higher incomes that could accompany coal development. Social benefits could include a reduction in poverty-related stress as well as the symptoms that accompany this stress, i.e., boredom, depression, and alcohol abuse. The degree to which these positive benefits occur depend entirely on how successful the applicant and the residents of Tyonek are in maintaining a high level of local employment.

The proposed project would have little effect on governing control over land that is currently owned or governed by TNC or the Native Village of Tyonek (i.e., they already can legally control access onto their land, if necessary). These lands, however, make up relatively little of Tyonek residents' customary use area which includes lands owned by the State, CIRI, KPB, and private individuals in addition to TNC lands. Tyonek's voice in decisions related to the use of lands outside of their legal control would diminish as more and more outsiders work, recreate, and potentially choose to reside in the area. These activities would become a source of increasing conflict and local concern. For the first time in their long history, Tyonek residents would be a minority in their own region.

The Diamond Chuitna Coal Project has incorporated features that would tend to reduce adverse social and cultural disruption to Tyonek. Most importantly, the housing facility has been designed to accommodate only single workers rather than providing for permanent settlement by workers and their families and development of the infrastructure and services to support a self-contained town. In addition, the proposed transportation corridors and port sites are not located on Tyonek's land (though the southern corridor is in an area used frequently for subsistence harvests by Tyonek residents) and they are far enough away from the village to provide a "land buffer".

However, even though Tyonek can protect itself from physical intrusion of outsiders onto TNC or NVT controlled lands, protection of village culture or lifestyle is more difficult. Increased stress and social conflict would occur as a result of interaction between villagers and workers with vastly differing attitudes and values, resentment of the presence of coal mining activity by some villagers, conflicts between village subsistence hunters and fishermen and non-Native sportsmen, potential erosion of Tyonek's subsistence resource base, and potentially low long-term employment of Tyonek residents at the mine.

Finally, subsistence is perhaps the strongest and most important element of Tyonek's social and cultural value system. Maintenance of a subsistence-based livelihood is essential to prevent erosion of this value system. The effects of the proposed coal mining project on subsistence resource use is considered in Section 5.3.7.

5.3.7 Effect on Subsistence Resource Harvest

Five potential effects of mine construction and operation on subsistence resource availability and harvest are considered in this section: 1) effects on access to, and use of, customary use areas; 2) changes in fish and wildlife abundance; 3) interference with fish and wildlife life cycles or movements; 4) increased nonresident harvest of subsistence resources, including competition for fish and game with mine employees; and 5) the possibility of increasingly restrictive harvest regulations. The first two effects are most likely to occur as a result of the mine and mine facilities.

5.3.7.1 Effects on Access to and Use of Customary Use Areas

Tyonek residents currently use a 1,942 km^2 (750 mi^2) area between the Chuitna River to the north and the McArthur River to the south and approximately 216 km (135 mi) of coastline from the mouth of the Susitna River to Tuxedni Bay (Fall et al. 1984). The proposed mine and lease area are currently used relatively little by Tyonek residents. Although residents have historically used this area, its current use is limited to occasional trapping and moose hunting during hunting seasons when snow depths are insufficient to force moose to lower elevations (Foster 1985; Fall et al. 1984).

5.3.7.2 Effects of Changes in Fish and Wildlife Abundance

Subsistence resource harvest would also be affected by changes in fish and wildlife populations. Population changes would occur if there were changes in the amount of limiting habitat for important subsistence species. Habitat changes could be due to direct habitat loss (for example, by removal of vegetation) or due to indirect habitat loss (such as displacement of game by noise and general activity). In addition, there could be gains in total habitat following reclamation depending on plant species used for revegetation and success of reclamation.

From the best information available, it seems that there would be some direct moose habitat loss, at least until reclamation efforts are successful. Moose adapt well to human activity and disturbance. Hence, indirect habitat loss due to noise and disturbance is not expected to seriously affect moose populations or distribution. Given that moose abundance is not expected to decline drastically because of the project, adverse impacts to subsistence hunting should not be significant.

A net loss of salmon spawning and rearing habitat in the Chuitna River drainage would occur as a result of the

Diamond Chuitna project. Late in the mine life, during the years of maximum impact, chinook salmon escapement (the primary subsistence species) could be reduced by up to 30 percent per year (Table 5-11). Since salmon comprise 71 percent of the edible weight of subsistence resources harvested and approximately 17 percent of total village employment income (Section 4.7.2.2), a decline in salmon returns could cause a significant adverse impact to Tyonek's subsistence and commercial fisheries. The proportion of salmon caught in the marine subsistence fishery that originate in the Chuitna River cannot be determined on the basis of existing data. The location of the fishery suggests that Chuitna River fish would be caught in substantial numbers; however, maximum escapement to the Chuitna is a small fraction (less than 5 percent) of the Susitna River runs which undoubtedly contribute the majority of the Tyonek harvest. Reduction in available fish as a result of mine impacts would be expected to have a small, adverse impact on the fishery that would be difficult to detect within the context of natural variation of fish numbers.

5.3.8 Impacts to Visual Resources

In general, visual resource impacts would be limited by the low use level of the area within the viewshed of the project components. The project components most visible to viewing populations from the ground or water would be the port and conveyor system. All facilities would be readily visible from the air. In addition, the increased level of activity, including air and ship traffic at the site would affect visual resources.

Current use of the project area is limited to subsistence and recreational use by Tyonek residents and fishing and hunting by non-Natives. Based on reported moose and bear harvest locations (ERT 1984f), hunting is common to the east, northeast, and south of the project area but is rare within the project area itself. Fishing is focused on the Chuitna River and Lone Creek to the east of the project area and Nikolai Creek to the south. As noted in Section 4.10, up to 5,000 man-days are spent in the local sport fishery, not including subsistence. This level of effort would probably grow substantially over the next decade without the project since local guides plan to expand their services. Visual impacts on hunters and fishermen may therefore be important in terms of viewer attitude, but visibility of the project from primary hunting and fishing areas would be very limited.

Except for the overburden stockpile and offshore port facilities, project facilities would not be visible from most ground-level vantage points over 1.6 km (1 mi) away due to visual screening offered by vegetation and topography and the low heights of structures. The overall visual impact of the proposed project is assessed as low to moderate due to:

1) the low use of the area for purposes other than hunting and fishing (primarily recreation use by Tyonek residents and commercial fishing and oil and gas extraction in the Cook Inlet in the port vicinity); 2) low visibility of the project from ground-based locations; and 3) the project area's medium-high scenic quality rating (Section 4.8).

5.3.9 Impacts to Recreational Resources

Direct adverse impacts to hunting arising from the approximately 2,051 ha (5,068 ac) of land disturbed by the mine and mine service area would be minor due to the low level of use of the project area by hunters. Effects on hunting east and south of the project area would likely be minimal. Most mine facilities would be located upstream from portions of the Chuitna drainage that are used by sport fishermen. Therefore, direct physical disruption of popularly fished stream reaches within the project area by construction and operation of project facilities would be minor.

Reductions in some fish populations would be expected. The worst case analysis described in Section 5.1.3.2 suggests that populations of popular sport species (chinook and coho salmon) could be substantially reduced in the Chuitna River during the years of maximum impact late in mine life. This loss would reduce harvest rates and thereby lower the quality of the project area for sport fishing during the years of impact.

High turbidity resulting from construction or mine operation could have an adverse effect on the aesthetic and recreational enjoyment of streams. Salmon or trout fishing, especially fly fishing, is not feasible in waters where turbidity exceeds 20 to 25 NTU. Any increased duration of turbid conditions in the Chuitna River downstream of Lone Creek might temporarily reduce the effectiveness of sport fishing efforts in the area.

Indirect impacts would arise due to this alternative's effects on visual resources. The visual presence of the project would reduce the quality of the "wilderness experience" for hunters and fishermen who view project facilities during flights into the area and from the ground. Noise impacts would similarly reduce the quality of the recreational experience. These latter impacts would probably be significant given the high quality experience that the area now provides.

5.3.10 Impacts to Cultural Resources

The impacts of the mine and mine service area on cultural resources in the project area would be minimal. The baseline cultural resource site survey (Gerlach and Lobdell 1983) disclosed no archaeological sites in the area of the mine and mine facilities. The possibility of disturbing cultural resources outside the construction zone as a result of increased human presence in the region is expected to be slight given the topography, vegetation, and small number of known sites.

5.3.11 Regional Use

Most of the areas in the Beluga Region which are likely to be developed in the future for coal, timber, hard rock minerals, or hydropower are located to the west of the proposed mine site. It is unlikely that the mine itself and the mine service facilities would be easily used by or benefit regional development.

5.3.12 Technical Feasibility

Adequate technology exists to develop the mine and mine service area as proposed.

5.4 APPLICANT'S PROPOSED PROJECT

As described in Chapter 2.0, the applicant's proposed project consists of two possible transportation corridor/ port site options: a southern transportation corridor leading to a Granite Point port site or a northern transportation corridor leading to a Ladd port site (Fig. 2-1). Project alternatives incorporating either of these options could be selected by the applicant depending on economic and other factors.

5.4.1 Southern Transportation Corridor; Granite Point Port Site

5.4.1.1 Impacts to Terrestrial Environment

Physiography, Geology, and Soils

The major construction and operation impacts of the southern/Granite Point alternative related to physiography, geology, and soils would result from gravel extraction and placement. Gravel placement and extraction would occur during construction and maintenance of the road, drainage structures, and facilities. The coal transportation system and roadway component consists of the main haul road, overland conveyor, the conveyor access/service road, and transfer facilities at each end of the overland conveyor. Approximately 1.9 million m^3 (2.5 million yd^3) of material would be required for construction of this component.

The port facilities component consists of onshore and offshore facilities. The onshore facilities would be located on an elevated pad consisting of approximately 2.0 million m^3 (2.6 million yd^3) of material.

Construction of the coal transportation system and adjacent haul road would disturb about 70 ha (173 ac) of primarily Strandline sandy loam soils on a 35 m (116 ft) width of the right-of-way although 16 ha (40 ac) of Starichkof-Chichantna peats and 10 ac (25 ac) of Starichkof peats would also be disturbed. Onshore port facilities at Granite Point would require approximately 80 ha (198 ac) of primarily Starichkof peat soils.

Long-term disturbance of soils is expected to occur as a result of construction of the coal transportation system and the haul road. Blading for the roadway and for the footings of the conveyor system would irreversibly disturb soils. An irreversible disturbance is construed as one having no forseeable restoration within 100 years. The longevity of the restoration is dictated by the soil-forming rate which in the regional climate is extremely slow (Douglas and Tedrow 1959; Brady 1974).

Vegetation

A corridor approximately 19.3 km (12 mi) long and 35 m (116 ft) wide would be cleared for the construction of the coal transportation system and the road right-of-way. This would mean elimination of 69 ha (171 ac) of, primarily, mixed spruce-birch woodland. A total of 16 ha (39 ac) of open low scrub/sweetgale - grass fen and 16 ha (39 ac) of mesic bluejoint graininoid herbacious vegetation would also be eliminated by construction clearing in this corridor.

In addition to direct disturbance from clearing activities, the potential also exists for vegetation to be indirectly affected during operation. An increase in foot traffic, off-road vehicle use, vehicle road dust, and coal dust emissions would be expected during mining and coal transportation. Studies of gravel roads on Alaska's north slope suggest that dust is deposited in a shadow tens or hundreds of meters from roads depending on wind conditions (Everett 1979). Roadway and coal dust could reduce plant growth rates near the mine, mine service area, and transportation corridors by physically impeding leaf gas exchange or by bioaccumulation of materials in leaf tissue (Olson 1982; Smith 1981). Lichens would be especially sensitive to such accumulation (Hale 1981), but conifers could also be affected if concentrations are great enough (Treshow 1970). Also, such fallout can cause reduction in soil acidity which may alter plant composition in the vicinity of roads. Acid-loving plants such as mosses could become less abundant over the long-term and grasses and sedges more abundant. The effects would be noticeable only adjacent to roadways within the dust shadow and would not be significant on a regional basis. Dust control measures would minimize adverse impacts. Coal dust would be deposited on vegetation within very limited areas immediately below the conveyor and adjacent to transfer facilities. Transfer facilities would be covered and the conveyor would be protected on one side by a windshield, thus adverse impacts to vegetation are expected to be insignificant.

Damage to vegetation could also occur from fuel and chemical spills. The degree of impact would depend on the amount of the spill, the time of the year, type of community, and type of action required for the cleanup (Brown and Berg 1980). Spills in communities with wet, organic soils during the growing season are considered to be more damaging than those occurring in mineral soils or those occurring in winter. Spill contingency plans would help to prevent or minimize damage.

Long-term adverse impacts on vegetation would occur in areas that are cleared and used continuously during mining. Reclamation operations could not be implemented until the conveyor and transportation corridor and port loading facilities were dismantled. Reestablishment of vegetation would not occur until 10 to 15 years after project completion. However, because the plant communities affected by construction of these facilities are well represented in the area, impacts to the vegetative resource are not expected to be significant.

- Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within the southern transportation corridor or the Granite Point port site.

Wetlands

Approximately 14 ha (35 ac) of wetlands would be disturbed by the southern transportation corridor. The majority, i.e., 11 ha (26 ac), would be classified as palustrine - scrub/shrub broad-leaved deciduous/emergent narrow-leaved persistent. Material sites would disturb 1.6 ha (7 ac) of wetlands and the Granite Point port facility would adversely affect 70 ha (173 ac) of wetlands (Table 5-2).

Table 5-2 shows the types of wetlands disturbed for each facility and compares the alternative corridors. The surface area of wetland affected by the southern/Granite Point alternative is greater than the eastern/Ladd alternative and the northern/Ladd alternative because of the substantial wetland affected by the Granite Point port site.

In addition to direct adverse impacts, wetland structure and function would be altered adjacent to project facilities. Indirect impacts would include blockage of natural drainage patterns and disturbance of wetland inhabitants. Wetland values are discussed more fully in Sections 4.3.3 and 5.4.1.2.

Wildlife

Impacts to wildlife include direct habitat loss, indirect habitat loss (inability to use a habitat), effects on animal movements, and construction impacts.

- Southern Transportation Corridor

Construction of the southern corridor, including the conveyor and access/haul road, would cause a direct habitat loss of approximately 69 ha (171 ac). This loss would be significant only on a local basis for song bird, waterfowl, shorebird, small mammal, and furbearer populations and would not be significant even on a local basis for other bird and mammal species.

Indirect habitat loss for song bird, shorebird, waterfowl, small mammal, and most smaller furbearer populations, including beaver, could be significant on a local basis, but these species would likely adapt (to varying degrees) to the presence of the conveyor and access/haul road (Univ. Maine 1983).

The lone bald eagle nest tree within the southern corridor (Fig. 4-4) is located between the conveyor and the haul road. These facilities were aligned specifically to avoid the nest tree and it would be at least 457 m (1,500 ft) from both rights-of-way. No direct project-related activities would occur within that distance. Normal project activities would likely not cause disturbance which would affect breeding success of eagles using this site during the operational phase of the project, including the two-year initial coal trucking period (Hodges 1985).

Two trumpeter swan nest sites are located close to the proposed conveyor alignment. The site in the bottom of the Chuitna River canyon (Fig. 4-4) would be located about 305 m (1,000 ft) east and 52 m (170 ft) vertically below the conveyor as it crosses the river by suspension cables and would be about 543 m (1,781 ft) northwest of the access/haul road at its closest approach. No direct project-related activities would occur within that distance. In Alaska, however, swans very seldom nest within viewing distance of roads (King 1985). This site would be screened from much of the access/haul road by vegetation, but the road would be visible on the north side of the canyon. Historical evidence tends to indicate this nest site has not been regularly and successfully used (ERT 1984f). Swans are very aware of objects above them (King 1985) and would, therefore, be aware of the suspended conveyor. The limited historical use of the site, coupled with the presence of the road and suspended conveyor, would likely prevent use of the site for nesting during the life of the project.

The second swan nest site is located approximately 381 m (1,250 ft) west of the conveyor alignment in the vicinity of Congahbuna Lake (Fig. 4-2). The conveyor and access/haul road alignment would be further away from the site than the existing network of logging roads. Therefore, negative impacts from the project would probably add very little to those that exist at present.

Although no specific sandhill crane breeding has been reported within the southern transportation corridor, breeding and foraging habitat may exist in the southern portion of the corridor just north of the Granite Point port site. Cranes have been frequently sighted in the vicinity of the southern portion of the corridor. Operation of a conveyor and access/haul road through this area would likely discourage use of the area for nesting and possibly for foraging.

Moose and black bears would likely avoid the corridor during operation to some degree until they adapted to activities within it. This avoidance would be significant only on a local basis and long-term indirect habitat loss for these species would be minimal. Brown bears would likely avoid activities in the corridor to a much greater degree, perhaps causing a regional impact if such avoidance significantly interfered with movements across the corridor.

Assuming proper use of snow blowers to prevent high snow berms, the access/haul road would not pose a physical barrier to most animals wanting to move across it. During the first two years of operation, however, noise and other disturbance associated with truck traffic hauling coal from the mine to the port would discourage some animals from crossing or at least substantially reduce or delay normal movements across the corridor.

Since the conveyor would be elevated a minimum of 0.6 m (2 ft) above ground level, neither the mine area conveyor nor the main overland conveyor should pose a physical barrier to birds and smaller mammals crossing the corridor. Crossings capable of passing large mammals would exist in at least four locations along the mine area conveyor and in at least twenty locations along the overland conveyor (Fig. 2-7). At these points, the conveyor would be either buried or elevated a minimum of 2.4 m (8 ft) above ground level.

Moose crossing studies of the trans-Alaska pipeline system show that moose can cross under the pipeline at heights of 1.5 m (5 ft) or greater in winter (Eide and Miller 1979; Sopuck and Vernam 1984; Van Ballenberghe 1978). Eide and Miller (1979) found no correlation between pipe heights over 1.5 m (5 ft) selected by moose and snow depths under or near the pipe at depths up to 66 cm (26 in). Snow depths in the vicinity of the mine service area can reach 102 cm (40 in) or greater. Such depths could affect moose selection of conveyor crossing heights; however, the minimum 2.4 m (8 ft) heights at the crossings should provide adequate opportunity to pass moose even in deep snow.

When first encountering the conveyor, large mammals would have to move parallel to it until reaching a crossing. For the mine area conveyor, the average center-to-center distance between crossings would be approximately 849 m (928 yd), with a maximum distance between crossings of 960 m (1,050 yd). For the main overland conveyor, the respective values would be 880 m (962 yd) and 2,006 m (2,193 yd).

The conveyor would emit more or less continuous noise with levels probably in the range of 75 to 79 dba at 10 meters (33 ft). This noise level would be similar to the level associated with vehicle traffic on a public highway, but more constant. Noise levels would be substantially lower at buried wildlife crossings. It is anticipated that moose and black bear, when first encountering the conveyor, might shy away but that animals inhabiting the area would readily adapt to the constant noise. Noise would probably not prevent moose and black bears from crossing the conveyor at crossing areas. As mentioned above, brown bears are more sensitive to noise and activity as a whole and might be discouraged from approaching and crossing the conveyor.

To summarize, the movements of moose and black bears would be locally altered by the presence of impassible portions of the conveyor system, but it is expected that regional movements would not be significantly affected because of the availability of crossing areas. Brown bear movements and access to traditional habitats would likely be adversely affected with possible regional significance.

Noise and disturbance associated with construction of the access/haul road and conveyor would have relatively little impact upon song bird, shorebird, and small mammal populations. Waterfowl and raptor nests near the alignments, however, might be abandoned if construction activities occurred nearby during the critical period from mating through the first few weeks after hatching. Bald eagles using the nest on the north side of the Chuitna River (Fig. 4-4) would be susceptible to disturbance if construction activities occurred within 100 m (110 yd) or if blasting occurred within 805 m (880 yd) between March 1 and July 1.

Excavation of gravel and other fill materials for use in project construction would cause an estimated maximum direct habitat loss of approximately 202 ha (500 ac)(Fig. 2-16). This would be significant only on a local basis for songbirds and small mammals, and possibly for waterfowl and shorebirds at site 8. An additional approximately 12 ha (30 ac) of habitat would be lost if the road to the Lone Ridge site were constructed. This would likely be significant only on a local basis to songbirds and small mammals. These local adverse impacts would be temporary because the gravel pits would be rehabilitated when they were no longer needed.

Indirect habitat loss and effects on movements for most species would be locally significant only during construction periods when animals would avoid the areas because of human activities. The Lone Ridge site would likely require a blast and quarry operation which would cause significant indirect loss of habitat for animals, especially brown bears and moose, because of the noise. Activity at this site during the fall would cause additional stress to moose which have already been forced off a portion of a traditional rutting area by activity at the mine site itself.

- Port Site

Direct habitat loss from construction of the onshore port facility at Granite Point would be approximately 80 ha (198 ac). For song bird, shorebird, cranes, waterfowl (including swans), and small mammal populations, this loss would be significant on only a local basis. For other species, including moose, this loss would not be significant, even on a local basis. Since the port site would be located within poor to moderate value winter range and moderately important spring, summer, and fall moose range, direct habitat loss for moose would not be significant.

Indirect habitat loss would not be significant except for moose and black bear as most species would adapt to the presence of the facility (Univ. Maine 1983). For moose and black bear, indirect habitat loss initially could be locally significant, but these species would likely acclimate to some extent with time to the noise and activities. Brown bears would not be significantly affected since they are very seldom found in this area.

The onshore port facility itself would not have a significant effect on animal movements, but it would contribute to some movement interference because of its location at the southern terminus of the conveyor. Animals would be able to move around the facility by crossing the conveyor at designated animal crossings, including one immediately north of the port site (Fig. 2-7).

Construction activities at the port, aside from direct habitat loss, would have relatively little impact upon birds and small mammals. However, construction would displace moose and black bears to a greater degree than during operation of the facility and might be of local significance.

- Habitat Evaluation

The results of the habitat evaluation study performed for this EIS (Appendix A) are summarized for the various ancillary facilities in Table 5-24. The southern transportation corridor and Granite Point port site would directly affect about 80 ha (198 ac) of suitable sandhill crane habitat, no suitable trumpeter swan habitat, 149 ha (369 ac) of

Table 5-24

DIRECT LOSS OF WILDLIFE HABITAT AND SUITABILITY OF HABITATS IN HECTARES (ACRES) FROM MINE DEVELOPMENT BY PROJECT COMPONENT

		Port Sites		Transportation Corridors			Housing Facilities and Airport			Material Sites[1]		
Species		Granite Point	Ladd	Southern	Eastern	Northern	Lone Creek	Three-Mile	Congahbuna Lake[1]	#5	#7	#8
Sandhill	Suitable	64(158)	6(16)	16(40)	14(35)	23(56)	0	0	6(15)	0	0	15(37)
Crane	X	0	0	0	0	0	0	0	0	0	0	0
	X	0	0	0	0	0	0	0	0	0	0	0
	Unsuitable	16(41)	113(277)	53(131)	40(99)	50(124)	29(72)	29(72)	23(57)	106(262)	119(294)	119(294)
	High	0	9(23)	0	2(6)	1(3)	0	0	2(5)	0	0	0
Trumpeter	Medium	0	0	0	0	0	0	0	0	0	0	0
Swan	Low	0	0	0	0	0	0	0	0	0	0	0
	NU[2]	80(198)	110(271)	69(171)	52(128)	72(177)	29(72)	29(72)	27(67)	106(262)	119(294)	134(331)
	High	80(198)	116(287)	69(171)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)
Black Bear	Medium	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
	High	80(198)	116(287)	67(166)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)
Brown Bear	Medium	0	0	2(5)	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
	High	0	0	22(54)	4(10)	5(12)	25(62)	0	10(25)	85(210)	119(294)	91(224)
Moose	Medium	74(183)	116(287)	46(114)	50(124)	68(168)	4(10)	29(72)	19(47)	21(52)	0	45(111)
Spring/Summer/	Low	6(15)	0	1(3)	0	0	0	0	0	0	0	0
Fall	NU	0	3(7)	0	0	0	0	0	0	0	0	0
	High	0	0	1(2)	0.5(2)	2(4)	0	0	10(25)	0	119(294)	0
Moose	Medium	16(41)	110(271)	3(8)	29(73)	32(79)	0	29(72)	2(5)	0	0	0
Winter	Low	64(157)	6(16)	38(93)	14(34)	22(53)	0	0	3(6)	0	0	0
	NU	0	3(7)	28(68)	19(47)	18(45)	29(72)	0	14(36)	106(262)	0	134(331)
Total		80(198)	119(293)	69(171)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)

[1] Exact sighting not finalized.

[2] Not utilized.

high quality black bear habitat, and 147 ha (364 ac) of high quality brown bear habitat. Spring/summer/fall moose habitats disturbed would be primarily low and medium quality.

The southern/Granite Point alternative would disturb more sandhill crane habitat than would the Ladd port site alternatives, but significantly less medium quality moose winter range.

5.4.1.2 Impacts to Freshwater Environment

Ground-water Hydrology and Water Quality

- Southern Transportation Corridor

Impacts to the ground-water system due to construction and use of the transportation corridor would be minimal compared to those resulting from the actual mining operations. Disruption of recharge or discharge areas would be a permanent impact; however, the area disturbed would be small compared to the total recharge/discharge area. Substantial impacts might occur due to fuel or chemical spills during construction and operation of the conveyor and haul road. These impacts could be reduced in magnitude if spill control and prevention measures are followed. Road construction gravel pits could also cause local disturbances to hydrological regimes. If such impacts occurred, they would likely be minor.

- Granite Point Port Site

Potential ground-water impacts during construction and use of the port site would include ground-water quality degradation as a result of chemical or fuel spills from storage and transfer areas. A Spill Prevention, Control, and Countermeasure (SPCC) plan would be prepared and implemented for this facility. Although contamination as a result of spills presents a significant risk to surface water and localized ground-water regimes, prompt and proper use of the SPCC plan would minimize the magnitude of any impacts.

Adverse impacts to ground-water quality could occur from water percolating through the coal stockpile and into ground water. These effects are anticipated to be insignificant. Column and drip leachate tests on Beluga coal (Table 5-25) indicate that drinking water standards would not be exceeded. Freshwater aquatic life criteria for boron, iron, ammonia-nitrogen, manganese, and zinc could be exceeded periodically, but the levels of these parameters would be diluted if water percolating through the coal reaches ground water. Further dilution would occur if the water resurfaces in a stream or lake. In addition, existing water quality for these parameters is periodically above standards. Therefore, no significant cumulative water quality impact is anticipated.

Table 5-25

EFFLUENT WATER QUALITY FROM COAL LEACHATES

Parameter	Column (1) Leachate	Drip (1) Leachate	Standard (2)
Alkalinity as $CaCO_3$	52	52	20 or more
Aluminum, dissolved (mg/l)	0.2	<0.2	---
Arsenic, dissolved (mg/l)	0.005	0.003	0.05
Bicarbonate as $CaCO_3$ (mg/l)	52	52	---
Boron, dissolved (mg/l)	0.41	0.52	0.043*
Cadmium, dissolved (mg/l)	<0.005	<0.005	0.004*
Calcium, dissolved (mg/l)	8.3	9.8	---
Carbonate as $CaCO_3$ (mg/l)	0	0	---
Chloride (mg/l)	7	13	200
Chromium, dissolved (mg/l)	<0.02	<0.02	0.05
Conductivity (umhos/cm @ 25°C)	260	290	---
Copper, dissolved (mg/l)	0.12	0.10	1.0
Fluoride (mg/l)	0.30	0.24	2.4
Hardness as $CaCO_3$ (mg/l)	36	43	---
Iron, dissolved (mg/l)	0.31	0.02	0.3*
Lead, dissolved (mg/l)	<0.02	<0.02	0.03
Magnesium, dissolved (mg/l)	3.8	4.4	---
Manganese, dissolved (mg/l)	<0.02	<0.02	0.05
Mercury, dissolved (mg/l)	<0.0005	<0.0005	0.0002
Molybdenum, dissolved (mg/l)	<0.2	<0.2	0.07
Nickel, dissolved (mg/l)	<0.2	<0.2	0.025
Nitrogen, ammonia (mg/l)	0.40	0.28	0.020*
Nitrogen, nitrate/nitrite (mg/l)	0.22	0.08	10
Organic carbon, dissolved (mg/l)	35	80	---
pH (units)	7.4 - 7.8	7.3 - 7.7	6.5 - 9.0
Potassium, dissolved (mg/l)	3.0	1.9	---
Selenium, dissolved (mg/l)	<0.002	<0.002	0.010
Sodium, dissolved (mg/l)	22.6	32.1	250
Solids, dissolved (mg/l)	130	165	500
Sulfate (mg/l)	12	17	200
Zinc, dissolved mg/l)	0.34	0.083	0.030*

*Parameters with potential to equal or exceed standards.
--- = No standard known.

NOTES:

(1) Bookcliffs 1985.

(2) Standard listed is the most stringent for the various protected water uses in Alaska. Sources: EPA 1976; McNeely et al. 1979; Sittig 1981; ADEC 1982; ADEC 1984.

Leakage from sewer lines and the sewage treatment plant would also result in potential degradation of ground-water quality. This potential is considered small.

Ground-water pumpage for potable use would result only in localized impacts.

Surface Water Hydrology

- Southern Transportation Corridor

The coal transportation system and haul road includes the main haul road, overland conveyor, and related support facilities. The transportation corridor would occupy an area of approximately 69 ha (171 ac) distributed over six watersheds as shown in Table 5-26.

The area disturbed for the construction of the haul road would be about one-third of those shown in Table 5-26. The area disturbed for the conveyor system would also be a small portion (one-third to one-half) of the areas shown in Table 5-26. Therefore, hydrologic impacts related to construction of the transportation corridor would be insignificant.

A system of 32 culverts would be provided along the transportation corridor including crossings of the five streams listed in Table 5-26. These culverts would be designed to pass runoff from a 10-year, 24-hour storm with no damming of water on the upstream side. To facilitate drainage, ditches would parallel the road on either side. Thus, there would be no obstruction to the existing drainage pathways for surface runoff up to the 10-year, 24-hour storm. During storms more severe than this, short-term ponding of water may be expected on the upstream (western) side of the transportation corridor. This would have the beneficial impact of reducing the flood peaks on the downstream (eastern) side of the corridor but could cause erosion of the roadway.

Roadway construction in southcentral Alaska often causes icing or glaciation adjacent to roads by blocking sheet flow and/or interfering with subtle drainage patterns. Some increase in icing would be anticipated as a result of the transportation corridor. Icing of culverts caused by improper design or maintenance could cause ponding during breakup, blockage of downstream flow, and possible roadway erosion. Blockage of culverts by beavers would also have the potential of creating temporary hydrological changes and possible roadway erosion adjacent to the corridor.

During the operation phase, the runoff generated by the 51 ha (125 ac) of road surface would be about 3 to 4 times that generated at present. However, road surface area in each watershed would be a very small fraction of the areas

Table 5-26

WATERSHEDS OCCUPIED BY SOUTHERN TRANSPORTATION CORRIDOR

Stream	Drainage area near conveyor crossing	Drainage area within the corridor	Percent of watershed covered by the corridor
1. Chuitna River	230.1 km^2 (88.85 mi^2)	53.1 ha (131 ac)	0.23%
2. Tyonek Creek	3.89 km^2 (1.5 mi^2)	16.2 ha (40 ac)	4.2%
3. Old Tyonek Creek	29.79 km^2 (11.5 mi^2)	35.24 ha (87 ac)	1.2%
4. Unnamed tributary of Old Tyonek Creek	5.44 km^2 (2.1 mi^2)	22.28 ha (55 ac)	4.1%
5. Unnamed tributary south of Congahbuna Lake	10.1 km^2 (3.9 mi^2)	14.58 ha (36 ac)	1.4%
6. Area draining directly to Cook Inlet	N/A	20.65 ha (51 ac)	N/A

N/A = Not applicable

shown in Table 5-26. Therefore, the net impact on the streamflows and water levels of streams would be negligible.

In the postoperation phase, all facilities, which can not be beneficially utilized for other purposes, would be removed and the area graded to restore the premining drainage patterns as far as possible. Thus, the postoperation hydrologic impacts of the project would be insignificant.

- Granite Point Port Facilities

Construction of sediment ponds at the port facility would require approximately 4.05 ha (10 ac). Diversion ditches and sediment ponds would be built before any other construction activity begins. The surface runoff from disturbed areas would be routed through this system. The combined storage capacity of the three sediment ponds would be 38.5 ac-ft and the net evaporation in the area would be small. Therefore, the runoff volume which would not reach Cook Inlet would be extremely small and the hydrologic impacts of the construction of the port facilities would be insignificant.

During the operation phase, contaminated runoff from the coal stockpiles and equipment washdown areas would be routed to the sediment ponds and treated before being discharged into Cook Inlet. The runoff generated by the built-up areas would be 3 to 4 times that at present. Water storage in sediment ponds would partially attenuate this increased runoff. The net effect on the inflows to Cook Inlet would be negligible.

In the postoperation phase, all facilities which could not be beneficially used, would be removed and the area graded to establish drainage patterns which would carry all surface runoff to Cook Inlet with minimal soil erosion. Thus, the resulting impact on Cook Inlet would be negligible.

Surface Water Quality

- Southern Transportation Corridor

Erosion could occur during construction of the road and conveyor systems and associated support facilities and would continue until all disturbed areas were stabilized. Road and conveyor system construction would include seven stream crossings and construction near two lakes located downslope from the road. In addition, there would be about 4.8 km (3 mi) of construction across muskeg or peat areas. The conveyor would span all streams and would not create undue amounts of erosion. Road construction would entail cut and fill operations and bank disturbances at stream crossings. Increased turbidity and suspended solids levels resulting from watershed disturbances would be proportional to the area disturbed, site gradient, the distance from the disturbance to a stream, and erosion control techniques applied.

Drainage and sediment control measures would be implemented prior to the commencement of facility construction and would be maintained until disturbed areas were stabilized (ACZ Inc. 1985a). Drainage and sediment control measures include: 1) construction of collection ditches and installation of culverts under roads to collect and control runoff from road surfaces, embankments, and adjacent areas; 2) surfacing of main roads and facility areas with gravel material; 3) revegetation of road cuts, embankments, and other disturbed areas as soon as possible after construction to minimize erosion; and 4) utilization of specific localized sediment control measures in sensitive areas such as adjacent to stream channels. In these sensitive areas, applicable control measures would be highly site specific but would include one or more of the following:

- Collection/diversion ditches with rock filter dams
- Gradient terraces with dugout filter ponds
- Rock drainageways
- Placement of sediment filter fabric
- Use of straw or vegetative sediment filters

In addition to the planned drainage and sediment control measures described, regular inspection and immediate repair of surface erosion in facility areas would limit potential impacts to water quality.

Streams in the project area would receive inflow from the transportation system drainage containing higher total suspended solids concentrations than in the streams. The impact of this situation would mainly be dependent on the relative volume of flow from the disturbed sites and the receiving streams and on mixing. The degree of effect would diminish as stream flow increased and would be least when flow was high. Each stream has an inherent capacity to recover from damage caused by siltation. Much accumulated sediment would be flushed from water bodies annually during spring breakup and would be moved downstream. It is anticipated that the transportation system sediment sources would increase annual stream sediment load by no more than 7 percent, most of which would occur during high stream flow periods.

No petroleum products would be stored in the vicinity of the transportation corridor; therefore, the potential for spills into water bodies would be limited to vehicle accidents. Crankcase leaks and overturned vehicles could result in petroleum product spills, but quantities would be small. Appropriate maintenance and quick response to spills would reduce the probability of petroleum products reaching water bodies and adversely affecting water quality.

Coal and soil dust generated during operation would not adversely affect water quality. Dust control measures would be employed using limited applications of water sufficient to control dust but not result in runoff. The conveyor would be covered on the top and one side along its length and provisions would be added to catch coal particles that fall from the bottom where the conveyor crosses the Chuitna River and small streams.

- Granite Point Port Facilities

Site preparation at the port facility would be initiated with construction of drainage ditches and three settling ponds to minimize the effects of construction disturbances on receiving water quality. These sediment control structures would collect all surface runoff from the port facilities area, including the coal stockpile and fuel storage area (ACZ Inc. 1985b). Discharge from the ponds would be to Cook Inlet.

Equipment washdown wastewater would be generated during operation by washing coal dust from coal handling equipment and from the repair and maintenance shop. An oil trap would be installed to remove oil and grease. The wastewater would then flow into coal pile runoff ponds for settling and treatment. The coal pile runoff would be storm water collected from the coal storage areas, parking lots, and surrounding areas. This water would be treated by sedimentation and possibly chemical addition in the ponds to suitable levels and could be used as make-up water for coal pile dust suppression sprays if sufficient low-cost suitable water is not available from other sources. Only the excess storm water would be discharged.

During operations, adequately-treated surface water runoff from the port site would not adversely affect surface water quality. Domestic sewage at the port site would receive secondary treatment. The maximum number of people at the site during operation would be approximately 55 (ACZ 1985c). They would use about 8,517 l (2,250 gal) of water (per the NPDES permit application) and generate about 4.3 kg (9.4 lbs) of 5-day biochemical oxygen demand (BOD) per day. Secondary treatment would reduce this to less than 0.45 kg (1 lb) of BOD, which would be discharged to Cook Inlet via a pipeline along the trestle. Water quality in Cook Inlet would be unaffected by the treated domestic waste discharge.

Effects of petroleum spills would be the same as described above for the mine and mine service area.

Biology

- Southern Transportation Corridor

The applicant's proposed transportation corridor crosses the upper reaches of two tributaries of Stream 2003 (200302 and 200303) and two tributaries of Old Tyonek Creek, as well as Tyonek Creek, Old Tyonek Creek, and the Chuitna River. All of these areas have documented rearing use by juvenile anadromous, and probably resident, salmonids (ERT 1984a). Coho and chinook salmon spawning may also occur in the vicinity of the crossings of the three larger streams. Construction of the stream crossings would result in temporary bed disturbance and downstream siltation. In addition, runoff from disturbed areas and work pads in the respective drainages may also contribute to increased suspended sediments in the streams. Effects of this increased sediment load would be similar to those described above for mine area streams but would not be expected to last more than a year from completion of construction.

Stream crossing structures would be placed in a manner that would not interfere with passage of juvenile or adult fish so no adverse impacts are anticipated to result from the presence of culverts, bridges or other crossing structures.

- Port Area

No significant impacts to freshwater fish populations are expected at the Granite Point port site due to construction, operation or reclamation. Several small ponds that may be filled may have isolated fish populations (e.g., three-spined sticklebacks). However, if present, these would be of little local or regional importance.

5.4.1.3 Impacts to the Marine Environment

Oceanography and Marine Geology

- Physical Oceanography and Ice

The presence of the trestle piers, designed with a wide (122 m [400 ft]) spacing to minimize ice forces on the structure, would cause an insignificant change to the current and ice regimes. The increased turbulence caused by the piers would be very localized, extending perhaps 10-15 m (33-49 ft) in the downstream direction; this would be superimposed on an already very turbulent background. Overall alongshore/offshore circulation would not be altered in orientation or in magnitude.

Ice passage would be locally affected where it impinged on the piers, and especially at the berthing facility. This would be manifested in breaking of larger ice floes and generation of a downstream wake of broken sea ice. Ice jamming and stacking is unlikely due to the wide pier/dolphin spacings and deep water; in any case, tidal flow reversal would tend to start clearing any such ice formation within 6 hours.

- Marine Water Quality

Marine construction activities would generate localized turbidity, which would be negligible compared to the high concentration of suspended solids in Cook Inlet waters. No dredging would be required for this planned construction.

Planned wastewater discharges into Cook Inlet marine waters during operation would derive from the sediment ponds and sanitary wastes. The former would include both natural sediments and runoff from the coal stockpiles, fuel storage, and maintenance yard areas. The latter would only be wastes generated at the port facility handled through the sewage treatment plant. The sediment pond wastewater would also be treated if necessary prior to release into Cook Inlet. Both of these effluents would be discharged offshore from an outfall on the trestle and they would be controlled by an NPDES permit (see Appendix D). Monitoring of the water quality would be required to assure that the effluents meet the required standards before discharge into the marine environment.

Cook Inlet is an essentially unpolluted water body, high in sediment, having point sources only at widely spaced locations, including Anchorage, Kenai, the offshore oil and gas platforms, and other scattered sites. Mixing and oxygen content are very high causing rapid dilution of pollutants and oxidation of organics. The high suspended solids in Cook Inlet waters may contribute to settling and deposition of some types of pollutants. The permitted discharge quantities from this project are anticipated to be essentially undetectable beyond the immediate area of the facility.

Unplanned discharges into the marine waters from spills could include diesel, gasoline, lubricants, and/or antifreeze. Such hydrocarbons are refined and potentially toxic; however, they also tend to degrade quickly in the marine environment. Large spills of crude oil resulting from rupture of one of the undersea production pipelines in the area would also be a very remote possibility (see discussion below under Marine Navigation). Spilled materials would be rapidly diluted under Cook Inlet conditions with strong lateral and vertical mixing. Local spill trajectory would be dependent on tide stage as well as wind and wave direction. However, the residence time would be relatively short; net flow is expected to be southwestward from the site, out of Cook Inlet. Risk of significant spill impacts would be reduced by incorporation of an SPCC plan into the port operations. This would include specialized training for the personnel, plus mechanical safeguards such as quick-closing valves in case of unexpected disconnections. Such risks would be further reduced by avoiding fuel offloading operations in adverse weather.

Accidental spills of coal could also occur during shiploading. Such spills would be unlikely and would probably involve small quantities. Coal would not be a significant pollutant. Coal debris is found naturally in Cook Inlet as a result of erosion of marine outcroppings.

- Coastal and Marine Geologic Processes

Shoreline, or seafloor, erosion or deposition impacts from the proposed construction would be localized and negligible. Scour depressions could occur around the trestle piers, although some scour protection might be installed. The barge unloading facility on the beach would be oriented parallel to the shoreline, would not extend onto the tidal flats, and would be generally above high water. Therefore, local changes to the shoreline would be minimal.

The wide pier spacing would not cause significant shoaling or shoreline deposition. No "sand bar" development at the offshore site would be expected.

- Marine Navigation

The routine operations of vessels using the Granite Point coal port should not affect the nearby offshore oil platform activities. These facilities may influence navigation under some sea and weather conditions, but may be considered navigation aids as well. Oil and gas pipelines buried under the seafloor occasionally become exposed in places because of erosion of bottom materials and thus become vulnerable to being snagged by anchors dragged across them. There would be a small risk of rupturing one of the pipelines extending eastward from Granite Point either while anchoring construction barges for trestle construction or in an emergency situation if a drifting coal vessel were to drag an anchor across an exposed portion of a pipeline. The former possibility would be preventable by careful construction management. A ruptured oil pipeline would result in a substantial oil spill.

The increase in marine traffic in Cook Inlet due to this facility would be notable; 150 to 250 vessel transits throughout the year would be added. This would roughly double the regional traffic of larger vessels; however, it should not represent a significant increase in congestion because of the distribution of marine traffic and the location of this site. The main year-round marine activity in the vicinity is the offshore platform operations which involve only a few vessels with very experienced crews. Most traffic is headed to other destinations in Cook Inlet, such as Drift River, Anchorage, and Nikiski. The main impact of this traffic increase would be in pilotage and regulatory clearance activities, normally conducted out of Homer. Fishing vessel activities range across the potential routes for the coal vessels; however, traffic density is very low and no significant adverse impacts would be anticipated.

Biology

Construction of the offshore port facilities would have little direct adverse impact on marine biota in the area. Placement of piles for pier and dolphin construction would disturb a small area of bottom; however, benthic biota are generally sparse or lacking altogether in the area. Driving steel or wood piles during port construction would have the potential for disruption of migration patterns of juvenile and adult anadromous salmonids due to noise. Juveniles can be presumed to be moving largely at the mercy of strong tidal currents and are therefore unlikely to be greatly influenced. Although there is little information regarding the reactions of adult salmon or marine mammals to bursts of waterborne noise such as would accompany pile driving, it is possible that some or many fish and/or marine mammals (e.g., belukhas) moving northward and eastward along the shore might alter their movements to avoid the area during construction. It is not likely that such a deviation in migratory pathway would reduce the number of fish escaping to nearby rivers.

Because of the natural high turbidity in the area, any increases from construction activities would be negligible and, therefore, adverse impacts to marine organisms should also be insignificant.

Normal operation of the coal port facility would have little direct impact on marine biota. The caissons and piles would provide a stable hard substrate that is largely free from burial by moving sediments. However, annual abrasion by ice would prevent establishment of more than an annual epibiotic* community. Turbulent wakes forming behind the caissons or piles would generate some waterborne noise; however, this would differ little from that which is naturally produced by currents passing the large boulders which are common in the shallow nearshore waters of Cook Inlet. Areas of lower velocity behind the piles might be used by some marine animals seeking refuge from the current.

There is little information about the reactions of belukhas to the chronic low noise levels likely to be generated at the port during ship loading. Belukhas do not generally appear to be disturbed by docks and ships and have not been observed to avoid the oil and gas platforms in Cook Inlet (Calkins 1985).

During periods of fog, the trestle and any elevated wires on it might constitute a hazard to flying birds.

However, this is not expected to be a significant problem because of the minimal use of the area by birds and because of the low likelihood of collision.

Construction and operation of the facility would not adversely impact any threatened or endangered species because of the absence of such species in the area.

In the unlikely event of a rupture of a diesel or gasoline line on the trestle or of a spill of any petroleum hydrocarbon from a vessel tied up at the wharf, the areas most likely to be adversely impacted would be the broad mudflats to the north and south of the port. Extremely dynamic conditions and lack of significant biota would render effects on the sand and gravel upper beaches around Granite Point negligible. The refined products most likely to be spilled in such an accident would weather quickly under most conditions. However, the rate of transport of spilled hydrocarbons would be rapid and the toxicity of refined products is high. If such a spill coincided with an extreme high tide or wind condition, the salt marshes fringing Trading Bay, Beshta Bay, or the Susitna Flats may be adversely affected. Oiling during such conditions could seriously damage saltmarsh vegetation and kill large numbers of salt-marsh invertebrates, primarily insects. Serious oiling of birds could occur if such a spill occurred during the spring or fall migration and staging periods for waterfowl. During the summer, oiling of these marshes would similarly damage breeding birds and reduce reproductive success. The likelihood of such a spill is low, certainly less than is already present in the area from existing offshore oil and gas production and handling activities.

Commercial Fisheries

If waterborne noise generated during construction causes any offshore deflection of the alongshore migration of adult salmon, there could be a reduction in the harvest success of set net fishermen in the immediate vicinity. Conversely, noise generated at the offshore extremity of the structure might cause fish to concentrate closer to shore, increasing the harvest success of fishermen. However, there is little basis for determining the impact of such activities on fishing success. Certainly, construction activities over a period of 2 years would preclude access to some localized areas at some times for fishing and for navigation. This may affect access to some set net sites depending on the exact location of construction activities.

Once in place, the trestle should not directly interfere with fishing or navigation of vessels because of the negligible impact of the structure on fish movements and because the pile spacing and clearance above the water would allow free passage of most vessels used in the area. Activities associated with the barge landing facility, however, could cause significant impacts during fishing periods if not properly coordinated.

5.4.1.4 Air Quality Impacts

As discussed in Section 5.3.4, the proposed project area is designated as a clean air (attainment) area by EPA for sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), ozone (O_3), and lead (Pb). During project operation, air emissions would emanate from coal handling and transportation and port site activities. Fugitive dust would occur primarily as a result of port facilities construction and along the haul road during operations, whereas stationary PM emissions would result from the port and the conveyor. Specifically, fugitive dust emission sources during operations would be:

- loading of coal onto the overland conveyor system
- handling of coal at the port facility, including transfer points of the conveyor system and ship loading
- storage of coal at the port area (potential wind erosion losses)

Stationary PM emissions sources would be the conveyor and ship exhaust at the port (Tables 5-14 and 5-15). Considerable quantities of criteria pollutants (SO_2, NO_x, CO and THC) would also result from shipping operations.

Results of air dispersion modeling are discussed in Section 5.3.4. Basically, it appears that maximum predicted short- and long-term concentrations, when added to background levels, would not exceed NAAQS in Kenai, Anchorage and Tyonek. Any effects will primarily occur in the immediate vicinity of the development.

5.4.1.5 Noise Impacts

The port site would be one of the two areas (the mine is the other area) with the highest noise levels during project operations. Human receptors in the project vicinity would include project workers and occasional hunters and fishermen. Table 5-22 shows estimated sound levels generated by equipment and facilities.

5.4.1.6 Socioeconomic Impacts

Anchorage and Kenai Peninsula

Socioeconomic impacts to Anchorage and the Kenai Peninsula would be identical regardless of the mine facilities configuration (see Section 5.3.6.1). Consequently, impacts from the southern/Granite Point alternative would be the same as those from the other corridor/port site alternatives.

Tyonek

General socioeconomic impacts from a mine development have been described in Section 5.3.6.2. Impacts specifically deriving from the southern/Granite Point alternative would be similar to impacts from other corridor/port site alternatives. The Granite Point port site would be 12.9 km (8 mi) from Tyonek and thus would be well removed from most Tyonek community activities. Housing facilities, haul road, and conveyor also would be a substantial distance from Tyonek and no facilities would be on land controlled by TNC. On the other hand, an existing road provides easy access between Tyonek and the port site/haul road vicinity assuring some level of interaction between mine workers and the Tyonek community.

5.4.1.7 Effects on Harvest of Subsistence Resources

The proposed southern transportation corridor bisects Tyonek's primary subsistence use area. In fact, the majority of Tyonek's hunting occurs to the west of this proposed corridor alternative. In 1981, 87 percent of the moose harvested by Tyonek residents was taken west of the corridor location (Fall et al. 1984). This area is currently accessed in three ways. First, Tyonek residents travel to the McArthur River area by boat, primarily for moose hunting in the fall. In addition, areas to the west of the village are reached using the road network that was developed to facilitate logging and oil and gas exploration; this is the most important and heavily used route to the terrestrial hunting areas. Finally, off-road areas are traversed on foot as well as with snowmachines or all-terrain vehicles.

If the project were built, access across the transportation corridor would be provided for in three ways (Fig. 2-7). First, the KPB has required that road crossings be provided in three locations south of the Chuitna River to allow passage across the conveyor. In addition, the conveyor would be buried in ten locations to allow for wildlife crossings. These crossings could also accommodate off-road vehicle access to hunting areas. Finally, there would be at least seven places where the terrain dips at least 2.4 m (8 ft) to allow passage on foot or with an off-road vehicle beneath the conveyor. The largest of these underpasses would be at the Chuitna River, but there could be others as well. Access to hunting areas on the existing road network should remain unhindered if underpasses are located at existing road crossings.

Coastal travel should not be directly affected by the offshore approach trestle if boats are allowed to travel beneath the trestle. The trestle would be supported by single pilings every 122 m (400 ft), allowing ample room for safe travel between piles. In the event that secondary effects, such as changes in underwater topography, occur, there may be restrictions on travel in some conditions. For example, according to Tyonek fishermen, the pier at the North Foreland created a sandbar that hinders local travel, especially during rough weather. This latter possibility would be highly unlikely given the design of the trestle and the depth at the dockhead.

Some Tyonek residents also use the Chuitna River, Tyonek Creek, and Old Tyonek Creek for drinking water. If water quality in these streams is degraded due to erosion or other pollution from the roads, mine, or housing facility, use of these streams for drinking would be adversely impacted.

Actions that affect life cycles or movements of fish and game may also cause impacts to the harvest of subsistence resources. Again, moose and salmon are the two resources of primary concern. Restrictions in moose movements by the transportation corridor could cause changes in moose hunting success if moose were excluded from customary hunting areas; on the other hand, hunting pressure on local populations could be increased if moose are concentrated at crossing areas. This could result in population decreases and more restrictive hunting regulations in the future. If salmon detour around the port facility and trestle, either due to noise and general activity or due to the physical presence of the trestle, then commercial and subsistence harvests may decline near the port facility. Alteration of salmon movements would be unlikely during project operation but could occur during trestle construction. Interference with subsistence fish harvest would not be a long-term impact.

5.4.1.8 Impacts to Visual Resources

Visual resource impacts would be limited by the low use level of the area within the viewshed of the project components. The transportation corridor and port would be visible from the air. From the ground, the port and the conveyor system would be the most visible components. Increased ship traffic would affect visual resources to a certain extent. The overall visual impact is considered to be low to moderate.

5.4.1.9 Impacts to Recreation Resources

This area is not heavily used by sport hunters, sport fishermen, or other recreation users. Disruption of recreation is expected to be minor. Only limited disturbance is expected to moose and black bear movement patterns and habitat since the conveyor system would be designed for minimum interference. The visual presence of the project and noise generated may adversely impact the quality of the "wilderness experience." Since the wilderness aspect of the area is high at present, this impact would be considered significant.

5.4.1.10 Impacts to Cultural Resources

One archaeological site (TYO-064) is located in the vicinity of the proposed port facility. The archaeological investigators (Gerlach and Lobdell 1983) suggested that avoidance is the most acceptable mitigation strategy, assuming that the port facility engineering design can accommodate this measure. If the site were clearly marked and construction/operations personnel were informed of their obligation to ensure its integrity, no adverse impact should result.

Two other possible adverse impacts on cultural resource sites should be considered. The remote possibility of offshore cultural resource sites (such as shipwrecks) in the port site area remains to be addressed. If such sites exist, construction of an approach trestle conceivably could cause direct or indirect adverse impacts. The possibility of secondary impacts to cultural resource sites outside the construction areas as a result of increased human presence in the region would be slight given the topography, vegetative cover, and the paucity of known sites.

5.4.1.11 Regional Use

Most of the areas in the Beluga region which are likely to be developed in the future for coal, timber, hard rock minerals, or hydropower are located to the west of the proposed project. Construction of the southern transportation corridor, and particularly the Granite Point port site, would provide some infrastructure which could serve future developments (e.g., the Placer U.S. Center Ridge coal deposit which is located approximately 9.6 km (6 mi) west of this project's mine service area). Both the transportation corridor and port site would have the flexibility to serve other regional users. Adequate land coupled with a public land ownership pattern would permit expansion and would not preclude other uses. Further, the port site would be consolidated with the existing road system and developments including the Granite Point oil pump station, Nikolai Creek airstrip and the small group of homes and fishing cabins near Granite Point, allowing for more clustered or "nodal" development as opposed to scattered developments in the region.

5.4.1.12 Technical Feasibility

Adequate technology exists to develop the Granite Point port site, the haul road and the conveyor system as proposed. A shoal exists offshore of the Granite Point port site. It would be approximately 2,427 m (2,654 yd) from the end of the elevated trestle and would need to be considered in navigating coal ships during operations.

5.4.2 Northern Transportation Corridor and Ladd Port Site

5.4.2.1 Impacts to Terrestrial Environment

Geology, Physiography and Soils

Construction and operation of the northern/Ladd alternative would result in impacts to the physiography and geology primarily related to gravel extraction and placement similar to those described in Section 5.4.1.1 for the southern/Granite alternative. No figures are available for the estimated amounts of material needed for the northern/ Ladd alternative, but the amount needed would probably be greater than the 1.9 million m^3 (2.5 million yd^3) needed for the southern/Granite option due to the greater road length.

Development of a coal transportation-road system within the northern corridor and the facilities at Ladd port site would disturb about 192 ha (473 ac) of soils. Approximately 62 percent (119 ha [293 ac]) of the disturbed area would be associated with port site construction. The rest (73 ha [180 ac]) would be disturbed by road construction activities. Soil types affected would primarily include the Talkeetna Sandy Loam and Starichkof-Chichantna peats as well as Starichkof peats that are associated with wet areas.

Construction of transportation and port site facilities would result in long-term impacts to the soils that are disturbed during clearing and those that are covered by road bed materials and permanent facilities. Blading of the roadway and area for footings of port site structures and the conveyor systems is considered an irreversible impact, indicating incomplete restoration within 100 years (see Section 5.3.1.2).

Vegetation

The clearing of the right-of-way for the access road and the coal transportation system would eliminate the native vegetation in a corridor approximately 21.7 km (13.5 mi) long and 35 m (116 ft) wide. The major vegetation type eliminated would be 42 ha (104 ac) of mixed spruce, birch woodland. An additional total of 7 ha (17 ac) of closed alder tall shrub scrub and 23 ha (56 ac) of low shrub scrub/sweetgale-grass fen would also be eliminated by construction clearing.

Construction of onshore facilities at the Ladd port site would disturb or eliminate a total of 119 ha (293 ac) of primarily open mixed spruce, birch forest. An additional 6 ha (16 ac) of the open low shrub scrub/sweetgale-grass fen type will also be lost during construction. Approximately 3 ha (7 ac) of open water habitat would be eliminated. Because of the longer road length, the northern corridor would disturb somewhat more vegetated terrain than the southern corridor.

Wetlands

Approximately 28 ha (69 ac) of wetlands would be disturbed by the northern transportation corridor, most of which would be classified as palustrine - scrub shrub broad leaved deciduous/emergent narrow-leaved persistent. An additional 11 ha (28 ac) of wetland would be disturbed by the Ladd port site. A portion of the northern transportation corridor intersects the southern end of a large wetland complex that extends from Threemile Creek to the Beluga River.

Table 5-2 shows the types of wetlands disturbed for each facility and compares the alternative corridors and port sites. The total surface area of wetlands affected by the northern/Ladd alternative is less than the southern/Granite Point alternative because the Ladd port site contains relatively little wetlands even though the northern transportation corridor contains more wetlands than the southern corridor. The northern corridor contains substantially more wetlands than the eastern corridor.

Wetlands values are discussed more fully in Sections 4.3.3 and 5.4.1.2.

Wildlife

- Northern Transportation Corridor

Adverse impacts from direct habitat loss would be the same as for the southern/Granite Point alternative except that an additional approximately 4 ha (10 ac) or five percent of habitat would be lost because of the greater length of the route. Qualitatively, this alternative would impact habitat of greater importance to wildlife because of the increased loss of wetlands.

Potential indirect habitat loss would be greater than the southern/Granite Point alternative to migrating waterfowl (including swans), nesting waterfowl, and shorebirds because the corridor would cross the large wetlands area west of the Beluga power plant. Potential indirect impacts to eagle nesting would likely be similar to the southern/Granite Point alternative as each corridor has an eagle nest within 457 m (500 yd) of the access/haul road or conveyor. Adverse impacts on swan nesting from this alternative would also be similar. While the one nest site indirectly impacted by the northern corridor would be significantly further from the access/haul road and conveyor than the two sites in the southern/Granite Point alternative (approximately 1,006 m [1,100 yd] versus 305 m [333 yd] and 543 m [594 yd]), this site has consistently supported a successful nesting pair of swans whereas the other two sites have not.

Indirect impacts to sandhill cranes from this alternative would be less than that for the southern/Granite Point alternative since there is very little use of the northern corridor by cranes.

Activity associated with operation of this corridor would likely cause significantly greater indirect habitat loss for brown bears than would the southern/Granite Point alternative. The northern corridor would cross Lone Creek through riparian habitat important to brown bears for salmon feeding.

Adverse impacts to animal movements from this alternative would likely be greater than those for the southern/Granite Point alternative because of the increased length of the conveyor and the right angle bend to the south at the eastern end of the northern corridor. This alignment would likely cause more moose and bear interactions with the conveyor. The northern corridor is also more at right angles to major large mammal movements than is the southern corridor. If adequately designed and spaced large animal crossings were constructed, however, this difference should not be significant.

Noise and disturbance associated with construction of the access/haul road and conveyor would be similar to that for the southern/Granite Point alternative. Bald eagles using the nest on the eastern shore of Tukallah Lake (Fig. 4-4) would be susceptible to disturbance if construction activities occurred within 110 m (110 yd) or if blasting occurred within 805 m (880 yd) between March 1 and July 1.

- Ladd Port Site

Adverse impacts from direct and indirect habitat loss and construction activities would be approximately the same as for the southern/Granite Point alternative, except that there would be significantly less direct and indirect habitat loss for swans and cranes at the Ladd port site.

- Habitat Evaluation

The results of the habitat evaluation study performed for this EIS (Appendix A) are summarized for the various ancillary facilities in Table 5-24. The northern transportation corridor and Ladd port site would directly affect habitats similar in suitability to the southern/Granite Point alternative. Northern/Ladd would affect less high quality moose winter habitat and more medium quality moose spring/summer/fall habitat than would southern/Granite Point.

5.4.2.2 Impacts to Freshwater Environment

Hydrology

- Northern Transportation Corridor

Impacts to ground-water hydrology would be similar to those described in Section 5.4.1.2 for the southern transportation corridor.

The northern corridor would cross 5 streams (5 to 8 total crossings, depending on route), including 2 crossings of Threemile Creek, and 3 sizeable wetland areas. It would skirt both Tukallah and Viapan lakes. There is no site specific information regarding the watershed sizes, expected maximum and minimum flows, or other stream characteristics. However, road and conveyor construction would be similar to that described for the southern transportation corridor (Section 5.4.1.2). Although minor drainage structures may be required at some river crossings, no major bridges, such as anticipated for the Chuitna River in the southern corridor, are planned.

- Ladd Port Site

The Ladd port facility would incorporate sediment ponds, ditches, and other drainage structures similar to those described for Granite Point. The port site is located in an area of wetlands (including one small lake). There is no site specific information regarding the number and location of sediment ponds and diversion ditches or the location of the coal stockpile. Generally, it is anticipated that run-off would be 3 to 4 times that at present. Overall surface water impacts would be similar to those described for the Granite Point site.

Surface Water Quality

The kinds of impacts that could occur are the same as described in Section 5.4.1.2 for the southern corridor. Erosion could occur during construction and operation of the road and conveyor systems. Road and conveyor systems would be approximately 21.7 km (13.5 mi) long and would cross 5 streams and 3 significant wetland or muskeg areas. Wetlands water quality may be influenced for approximately 6.4 to 8 km (4 to 5 mi) of the route. Stream crossings would be generally low level minor structures. However, abutments at two streams (Lone Creek and upper Threemile Creek) would be in wetlands or transition wetland-upland areas. The stream crossing at an unnamed creek near the middle of the route would be near the confluence of two tributary portions of the creek. One tributary would parallel the corridor for over 0.5 km (0.3 mi) making roads and crossings more difficult to construct and limit erosion impacts. The route would also pass near two lakes and three smaller ponds.

It was estimated that the transportation system sediment sources would increase annual stream sediment loads in the southern corridor by no more than 7 percent. It is likely that sediment percentage increases in the northern corridor would be higher since streams are smaller and in more stable streambank conditions where background levels may be inherently lower.

Although the northern corridor is longer and crosses more wetland terrain than the southern corridor, the northern corridor crosses fewer major streams. Impacts to surface water quality would be similar for the two corridors. Water quality impacts would probably be insignificant along any corridor because of the ability to effectively mitigate these kinds of effects.

Biology

- Northern Transportation Corridor

The northern transportation corridor to the Ladd port site would have up to 8 crossings affecting at least 5 known or suspected salmonid-producing streams or tributaries. Streams 2003 and 2002 are important rearing and spawning areas for three species of salmon and also have documented use by resident salmonids (Section 4.5.2.2). No specific data are available, but the two crossings of the mainstem of Threemile Creek and the crossing of its largest tributary also likely occur in areas used by at least coho salmon and resident Dolly Varden. Other species may also be present. The nature of the habitat and the potential for the occurrence of spawning at the Threemile crossings is unknown. Remaining tributaries (200205, 200206, and 200301) are very small at the crossings but likely have habitat for coho and Dolly Varden in their lower reaches.

Construction of the stream crossings would result in temporary bed disturbance and downstream siltation. In addition, runoff from disturbed areas and work pads in the respective drainages may also contribute to increased suspended sediments in the streams. Effects of this increased sediment load would be similar to those described above for mine area streams but would not be expected to last more than a year from completion of construction.

Stream crossing structures would be placed in a manner that would not interfere with passage of juvenile or adult fish so no adverse impacts are anticipated to result from the presence of culverts, bridges or other crossing structures.

Passage of the access route within 0.4 km (0.25 mi) of Tukallah and Viapan Lakes would improve access to these water bodies. Increased fishing pressure could affect the existing rainbow trout fishery in these lakes. Road construction and traffic dust during operation should have only minimal impact on lake water quality and biota.

Impacts to fish resources would probably be similar when comparing the northern and southern corridors. The northern corridor could potentially affect several valuable small streams while the southern corridor crosses the Chuitna River.

- Ladd Port Site

No significant impacts to freshwater fish populations due to construction, operation, or reclamation are expected at the Ladd port site. Several small ponds that may be affected may have isolated fish populations (e.g., three-spined sticklebacks). However, if present, these would be of little local or regional importance.

5.4.2.3 Impacts to Marine Environment

Oceanography, Marine Geology, and Water Quality

It is anticipated that the effect of the Ladd port trestle and other facilities would be similar to those described for Granite Point. Oceanographic conditions are similar and facilities would be essentially identical except that trestle length at the Ladd port would be about 305 m (1000 ft) shorter than at Granite Point (assuming an 18 m [60 ft] depth as required for large coal ships). Offshore drilling platforms are not present near Ladd; consequently, hazards and navigation concerns associated with these platforms at Granite Point would not be a concern at Ladd.

Biology

As with the Granite Point facility, construction of the offshore port facilities should have little direct adverse impact on marine biota in the area. One potentially significant difference between the alternate port sites concerns the vulnerability of biological resources in the event of a spill of fuel, oil, or other hazardous substance. The Ladd port site would be located adjacent to the Chuit Flats at the mouth of the Chuitna River. An oil spill affecting the intertidal zone of the Chuit Flats could harm invertebrates, water birds, and juvenile salmon that inhabit the area. In addition, the broad Susitna Flats is located in direct alignment with the Ladd port site. This very valuable waterfowl area could be severely affected if a large spill coincided with high tide conditions. Generally, the resources at risk from spills are greater at Ladd than at Granite Point. It should be pointed out, however, that the likelihood of a large spill is low.

Commercial Fisheries

The kinds of impacts that could occur to commercial fishing from a port facility at Ladd would be similar to impacts that might occur at Granite Point. However, the commercial fishing effort between Chuit Flats and Threemile Creek is greater than in the Granite Point vicinity with nearly continuous set net sites in the proposed port area. The individual sites are also significantly more productive than those at Granite Point. Fishermen have expressed concern regarding the proposed port facilities at Ladd partly because of their experience with present use of the existing barge landing facility and the proposed increase in use during project construction and operation. Activities associated with this facility could cause significant impacts during fishing periods if not properly coordinated. At lower production levels, the coal barge loading trestle would be only approximately 168 m (550 ft) in length and thus associated activities would be close to the beach and would also require coordination during fishing periods. At full production, however, the coal loading facilities at Ladd would be 3,505 m (11,500 ft) offshore in deep water, well out of the nearshore fishing zone. Therefore, impacts, if present, likely would be greater at Ladd than at Granite Point.

5.4.2.4 Air Quality Impacts

The air quality impacts for the northern transportation corridor would be similar to those for the southern transportation corridor during the operational phase of the project. However, because the access/haul road is longer, the construction phase impacts would be greater. The northern transportation corridor haul road distance would be about 21.7 km (13.5 mi) as opposed to 18.2 km (11.3 mi) for the southern route. This approximately 16 percent increase in haul road distance would result in a greater fugitive dust air quality impact for the 24-hour and annual average total suspended particulate (TSP) standards. As mentioned previously, the 24-hour averaging period is of most concern regarding TSP air quality impacts. The peak 24-hour TSP concentration for the northern route would be 58 ug/m^3. Approximately 57 ug/m^3 would be generated by the southern route. When added to a background TSP concentration of 50 ug/m^3, the total impact would be 118 ug/m^3. This is well below the 24-hour TSP standard of 150 ug/m^3; therefore, the construction phase impacts for the northern route would not violate the applicable ambient air quality standard for TSP.

The port activities for this corridor route would be in closer proximity to the Tyonek area than a port at Granite Point. However, it is not anticipated that any ambient air quality standards or PSD increments would be violated during construction and operating activities associated with the northern corridor or Ladd port site.

5.4.2.5 Noise Impacts

The noise impacts for the northern/Ladd alternative would be similar to those described for the southern/Granite Point alternative. The Ladd port site would be 7.2 km (4.5 mi) closer to Tyonek than the Granite Point site; however, a buffer of 5.6 km (3.5 mi) would still exist between Tyonek and the port site and it is not anticipated that there would be significant noise impacts to Tyonek residents associated with construction or operation activities for this alternative.

5.4.2.6 Socioeconomic Impacts

Anchorage and Kenai Peninsula

Socioeconomic impacts to Anchorage and the Kenai Peninsula would be identical regardless of the mine facilities configuration. Consequently, impacts from the northern corridor/Ladd port site alternative would be the same as described for the southern corridor alternative.

Tyonek

Socioeconomic impacts to Tyonek and the surrounding area with a northern corridor/Ladd port site alternative would be nearly the same as described for the southern corridor/Granite Point alternative. A port site at Ladd would be substantially closer to Tyonek (5.6 km [3.5 mi] as compared to 12.9 km [8 mi]). However, there is currently no bridge across the Chuitna River, making access to the Ladd port site from Tyonek difficult at some times of the year (an ice road provides access in the winter). Although Granite Point is farther from Tyonek, an existing road provides easy access. The distance and access factors probably act to offset each other; the potential for interaction between mine workers and the Tyonek community are likely similar for the Granite Point and Ladd alternatives. If a bridge and improved road were constructed between Tyonek and Ladd at some time in the future, alternatives utilizing the Ladd port site would probably create significantly more intrusion by outsiders into areas traditionally used or occupied by Tyonek villagers. The kinds of impacts that might occur as a result of increased interaction are described in Section 5.3.6.2.

5.4.2.7 Effects on Subsistence Resource Harvest

Tyonek residents make relatively little use of the area north of the northern corridor; consequently, hindered access across this corridor would not affect many Tyonek residents. Use of the area by residents of the Beluga area is essentially unknown but is likely to be light because of the small population and lack of road access.

The northern corridor is likely to have somewhat greater effect on the movements of large mammals (moose and bear) than the southern corridor. This could impact the number of animals available in areas south of the Chuitna River used for subsistence hunting by Tyonek residents. The impact could be either positive or negative depending on whether animals were excluded from the area or kept inside it.

The northern corridor would not directly affect the Chuitna River or enhance access to the river such as might occur with the southern corridor; consequently, corridor-induced impacts to fish resources used for subsistence purposes would probably be somewhat less for the northern corridor than the southern corridor.

When all factors are taken into consideration, the northern corridor would probably have somewhat less impact on subsistence resources and their use than would the southern corridor.

5.4.2.8 Impacts to Visual Resources

As with the southern/Granite Point alternative, the road, conveyor, and port would be visible from the air; the port will be visible to ship traffic on the west side of Cook Inlet. The port will also be highly visible from the ground. None of the facilities will be visible from the Village of Tyonek or from Anchorage or Kenai. The magnitude of visual impacts would be essentially the same for a northern/Ladd alternative as for a southern/Granite Point alternative.

5.4.2.9 Impacts to Recreational Resources

The presence of the Ladd port could significantly affect existing recreation use and quality of current sport fishing at the mouth of the Chuitna River. At present, two sport fish guides take clients to the mouth of the Chuitna and areas further upstream for day fishing trips. The proximity of the port would increase competition for the resource by bringing more people to the area and would also decrease the quality of the experience by decreasing the wilderness aspects of the site. Sport hunting along the coast for waterfowl also could be expected to be affected by the influx of people into the area. The Ladd port site is not only close to the Chuitna River mouth but is much closer to the Beluga River Flats than is the Granite Point site.

The road and conveyor system would cross Threemile Creek three times, increasing access to this system at every crossing point. It also skirts both Tukallah and Viapan lakes. Tukallah Lake contains rainbow trout, Dolly Varden and 5 species of Pacific salmon; Threemile Creek flows through the lake. Viapan Lake contains rainbow trout. Both of these areas could be expected to experience greatly increased recreation use.

The road and conveyor are much closer to the Beluga River than any of the other alternatives. This area is currently used by sport hunters for both moose and black bear. A road parallel to the hunting area could be expected to introduce more hunters into the vicinity. The presence of all of the facilities would decrease the wilderness quality of this area.

The northern/Ladd alternative would probably have significantly greater impact on recreation use and quality than would the southern/Granite Point alternative.

5.4.2.10 Impacts to Cultural Resources

Reconnaissance surveys conducted in 1983 and 1986 (Lobdell and Gerlach 1983; Lobdell 1986) concentrated on the area from Granite Point to just north of Chuitbuna Lake; no surveys have been done along the proposed northern transportation corridor. Most sites identified in the surveys have been clustered along the coast and none have been found in the vicinity of the proposed Ladd port site. It is likely that a survey along the northern corridor route would not reveal significant archaeological or historical sites, if care were taken to investigate archaeological values prior to construction and to protect any which might be discovered, then impacts would not be expected.

5.4.2.11 Regional Use

Northern Transportation Corridor

This alternative would not be located as favorably as would the southern corridor with respect to most major potential developments within the Beluga region (e.g., the Placer U.S. Center Ridge coal deposit). It would, however, be more favorably located for the smaller Placer U.S. coal lease 8 km (5 mi) west of the Beluga power plant (Fig. 4-1).

The northern corridor would cross between 1.6 km and 2.4 km (1.0 to 1.5 mi) of private land which might restrict other potential uses in the future. The southern corridor would cross no private land.

Ladd Port Site

While the Ladd port site would be on public (Kenai Peninsula Borough) land, its location with respect to private lands in the area as well as its position between the mouth of the Chuitna River and Viapan Lake would probably make it less able to expand to accommodate other major potential users than would a port at Granite Point. Although the Ladd port site would not be consolidated with as many existing facilities as would the Granite Point port site, it would make use of the existing Ladd barge landing site and road system in the area.

5.4.2.12 Technical Feasibility

Adequate technology exists to build both the transportation corridor and the port site for this alternative. A shoal exists offshore of the Ladd port site which would be approximately 1,810 m (1,980 yd) from the end of the elevated trestle. It would need to be considered in navigating coal ships during operations.

5.5 EASTERN TRANSPORTATION CORRIDOR

5.5.1 Impacts to Terrestrial Environment

5.5.1.1 Geology, Physiography, and Soils

Development of a transportation system within the eastern corridor would disturb about 74 ha (183 ac) of soils. Of this, about 24 ha (59 ac) consist of organic soils associated with wetlands, sphagnum and sphagnum-shrub bogs, and black spruce woodland and forest. Starichkof-Chichantna peats and Starichkof peats are associated with these areas and are well represented in the corridor. Talkeetna Sandy Loam soils are associated with upland sites.

The amount of soils that would be disturbed by construction of the Ladd port facilities would be the same as that described for the northern/Ladd alternative.

Construction of a transportation system in the eastern corridor would cause fewer impacts to soils than would the northern corridor because less area would be disturbed (74 ha [183 ac] versus 98 ha [242 ac]). The nature of the impacts would be similar, consisting of soil destruction by construction activities that are required for a road or conveyor system.

5.5.1.2 Vegetation

A corridor approximately 15.9 km (9.9 mi) and 35 m (116 ft) wide would be cleared for construction of the access/haul road and conveyor system. This would result in the elimination of 36 ha (88 ac) of open mixed spruce/birch woodland, 4 ha (9 ac) of closed alder/tall shrub scrub, 15 ha (34 ac) of low shrub scrub/sweetgale-grass fens due to construction clearing. Impacts at the port site would be the same as described for the northern/Ladd alternative.

This alternative would have impacts similar to the southern/Granite Point alternative but less than the northern/Ladd alternative because the eastern corridor is substantially shorter than the northern corridor.

5.5.1.3 Wetlands

Approximately 15.5 ha (38 ac) of wetlands would be disturbed by the eastern transportation corridor, most of which would be classified as palustrine - scrub shrub broad-leaved deciduous/emergent narrow-leaved persistent. An additional 11 ha (28 ac) of wetlands would be affected by the Ladd port facilities.

Table 5-2 shows the types of wetlands disturbed and compares the alternative corridors and port sites. The surface area of wetlands affected by this alternative is less than either the northern corridor/Ladd port site alternative or the southern corridor/Granite Point alternative. Neither the transportation corridor nor the port site interfere with large wetland complexes.

Wetland values are discussed more fully in Sections 4.3.3 and 5.3.1.2.

5.5.1.4 Wildlife

Adverse impacts to wildlife due to construction, operation, and reclamation of this alternative would be the same as for the northern/Ladd alternative except as described below.

- Transportation Corridor

Direct habitat loss and wetlands loss would be less than for the northern/Ladd alternative. The quality of lost wetlands habitat for this alternative would be less than for the northern/Ladd alternative primarily due to the avoidance of the bog west of the Beluga power plant. This alternative would also adversely impact Lone Creek riparian habitat which is less important for brown bears feeding upon salmon than that affected by the northern/Ladd alternative.

Indirect habitat loss from this alternative would be less than for the northern/Ladd alternative since the latter would pass within 457 m (500 yd) of an eagle nest on the eastern shore of Tukallah Lake and would also pass through more important riparian habitat on Lone Creek for brown bears feeding on salmon.

Effects on animal movements would be similar except that the longer northern corridor would likely result in more moose and bear interactions with the conveyor. If adequately designed and spaced large animal crossings were built, however, this difference should not be significant.

Noise and disturbance associated with construction of the access/haul road for this alternative would be similar to that for the northern/Ladd alternative, except that this alternative would not entail timing restrictions for construction activities since it would not have to consider curtailing blasting to protect the Tukallah Lake eagle nest as would the northern corridor.

- Port Site

The impacts from this alternative would be the same since the Ladd port site would be used for both the northern and eastern corridors.

5.5.2 Impacts to Freshwater Environment

5.5.2.1 Hydrology

The eastern transportation corridor to the Ladd port site (Figure 2-8) would have at least 4 stream crossings (Streams 2003, 200301, 2002, and 200205). Crossings of 2003 and 2002 would have impacts similar to those described for the southern/Granite Point alternative. Remaining tributaries are small (200205) or crossed relatively high up in the drainage (200301). Impacts of construction of the access road would be similar to but of less magnitude and extent than for the northern route, since no crossing of Threemile Creek would be necessary. A loop of the major tributary to Threemile Creek enters the corridor but could be avoided by the final alignment. This alternative would likely pass more than 0.8 km (0.5 mi) from both Tukallah and Viapan Lake. However, it would likely pass within 0.4 km (0.25 mi) of Chuitbuna Lake.

Impacts within the eastern corridor would be similar to those of the northern corridor alternative. One less stream would be crossed, similar wetlands areas would be influenced, and the same number of lakes would be near the route. However, Threemile Creek would not be influenced nor would the wetlands north of Tukallah Lake. The eastern corridor would cross fewer creeks than the southern corridor and all creek crossings would be minor structures.

5.5.2.2 Water Quality

Oil and hazardous substance spill potential would be similar to other alternatives except that the terrain is more uniform and fewer major streams would be near the road suggesting that spill risk to water bodies would be less with the eastern corridor.

Overall water quality impacts are projected to be lowest on the eastern corridor route because fewer streams and wetlands would be crossed and no major streams or stream crossings would be involved.

5.5.2.3 Biology

The eastern corridor crosses Lone Creek near the mine site. Fish resources would be as described in Section 4.4.4. Few other waterbodies would be affected by the access/haul road and conveyor within this corridor.

Impacts to Tukallah Lake would be as described for Tukallah and Viapan lakes under the northern alternative (Section 5.4.2.2), possibly including increased fishing pressure and minor water quality effects during construction and operation.

It is anticipated that the eastern alternative would have significantly less impact on freshwater biological resources than would the southern or northern alternatives.

5.5.3 Impacts to Marine Environment

The impacts would be the same as those described in Section 5.4.2.3 for the northern/Ladd alternative.

5.5.4 Air Quality Impacts

The air quality impact for the eastern transportation corridor would be similar to that described for the southern corridor route. The haul road lengths for these two routes would be about the same (about 17 km [11 mi]). The eastern corridor would be shorter in haul road length than the northern corridor route; hence, the haul road air quality impacts would be somewhat less for this route.

It is not anticipated that ambient air quality standards or PSD increments would be violated for this scenario and its associated construction or operational activities.

5.5.5 Noise Impacts

The noise impacts for the eastern transportation corridor would be similar to those described for the southern corridor and the northern corridor.

5.5.6 Socioeconomic Impacts

Anchorage and Kenai Peninsula

Socioeconomic impacts on Anchorage and the Kenai Peninsula from the eastern/Ladd alternative would be identical to the other alternatives.

Tyonek

Impacts to Tyonek from an eastern corridor alternative would be similar to other alternatives with one important exception. A portion of the transportation corridor would be on land owned by TNC and, thus, the corporation (and the community) would receive base revenues and maintain some degree of control over the transport operation. The ability to retain a voice in activities that affect the quality of life in the village is perceived by village residents as desirable. The eastern corridor alternative would probably have the least adverse impact on the Tyonek community because of this control factor.

5.5.7 Effects on Subsistence Resource Harvest

Tyonek residents make little use of the area north of the Chuitna River; consequently, an eastern corridor alternative would have minimal impact on access to subsistence hunting and fishing areas from Tyonek. The extent of use by residents of the Beluga area is poorly known but probably light due to lack of access. This alternative would have the same potential for affecting animal movements as would the northern/Ladd alternative.

The eastern corridor would have the least potential for impact to fish resources relative to the other corridors.

Taking all factors into consideration, the eastern corridor probably has somewhat less potential for impact on subsistence hunting and fishing than the northern corridor and substantially less than the southern corridor.

5.5.8 Impacts to Visual Resources

The effect of this alternative on visual resources would be similar to that described in Section 5.4.2.7 for the northern/Ladd alternative. Both alternatives encompass the Ladd port site and both include a road and conveyor system in a similar geographic location.

5.5.9 Impacts to Recreation Resources

The impact of this alternative on recreation resources would be similar to, but somewhat less than, the effects of the northern/Ladd alternative. Both alternatives include the Ladd port site; impacts of this component are described in Section 5.4.2.8. The eastern road and conveyor location does not cross Threemile Creek; however, it does cross Lone Creek which is used to some extent by sport fishermen and a local fishing guide. Fewer total drainages are crossed compared to the northern corridor, which decreases the total impact to sport fish use and resources. This alternative is not located as close to Tukallah Lake or Beluga River which would lessen the impact somewhat.

5.5.10 Impacts to Cultural Resources

No archaeological surveys have been conducted along the eastern corridor; however, impacts are expected to be similar to those described for the northern/Ladd alternative.

5.5.11 Regional Use

The impacts of this alternative would be similar to those for the northern/Ladd alternative except that the eastern corridor would not cross the southern extreme of the Placer U.S. coal lease, thus making development of that lease somewhat less economically feasible. This was judged, however, not to be a significant difference considering the relatively small advantage it would provide to the leasee.

5.5.12 Technical Feasibility

Adequate technology exists to build the eastern transportation corridor and Ladd port site.

5.6 HOUSING ALTERNATIVES

5.6.1 Lone Creek Housing Site Alternative

5.6.1.1 Impacts to Terrestrial Environments

Physiography and Geology

Gravel extraction and placement for the housing facility and airstrip would have minimal effect on the physiography of the area. The housing facilities would be built on generally free-draining glacial material. Foundations and access roads for the housing facility would require approximately 30,500 m^3 (40,000 yd^3) of material; the airstrip and access road would require approximately 84,000 m^3 (110,000 yd^3) of material.

Soils

Clearing and grubbing operations related to construction of the housing and airstrip facilities would disturb approximately 29 ha (72 ac) of soil, primarily Strandline variant sandy loam. This is considered a major long-term disturbance due to the permanency of the facilities.

Vegetation

- Community Composition

Construction of the airstrip, housing units, and associated roads would eliminate 29 ha (72 ac) of mainly mixed spruce-birch woodland vegetation (Table 5-1). Damage to vegetation could also result from fuel and chemical spills depending on the type and amount of spill, time of year, type of vegetative community, and actions required for clean-up (Brown and Berg 1980). Spills in communities with wet, organic soils during the growing season are considered to be more damaging than those occurring in mineral soils or during winter. Spill contingency plans would help to prevent or minimize damage.

Reclamation could not occur until the housing and airstrip facilities were dismantled. Reestablishment of vegetation would not occur until 10 to 15 years after project completion. However, the plant communities affected by construction of these facilities are well represented in the area so impacts due to clearing are not considered to be a significant commitment of the vegetation resource.

Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within the housing and airstrip area.

Wetlands

Only 2 ha (6 ac) of wetlands are expected to be disturbed by construction of the airstrip and housing area. The type of wetlands disturbed would be scrub shrub broad-leaved deciduous/emergent narrow-leaved persistent (Table 5-2). This loss of wetland is considered to be insignificant.

Wildlife

Direct habitat loss from construction of the housing facilities and airstrip would be approximately 29 ha (72 ac). This would be significant on a local basis for song birds and small mammals, but would not be significant for other animals.

Indirect habitat loss for most species would be small and only locally significant as they would likely adapt to the presence of the facilities. However, some displacement of large mammals would occur, especially from human/animal interactions in the vicinity of the facilities. Brown bears would likely avoid the area entirely unless attracted by feeding or improper handling of garbage. The lone eagle nest near these facilities (Fig. 4-4) would be approximately 732 m (2,400 ft) south of the airstrip. This distance should be adequate to prevent long-term abandonment of the nest site due to fixed-wing aircraft activities, even during the nesting period.

Animal movements would not be significantly affected by the presence of the housing and airstrip facilities especially if snow blowers were operated such that high snow berms did not build up on the airstrip.

Construction activities at the housing site and airstrip, aside from direct habitat loss, would have relatively little impact upon bird and small mammal species. However, construction would displace moose and bears to a greater degree than during operation of the facilities and might be of local significance.

Animal/human interactions could be expected to occur during both construction and operations phases of the project. At all project facilities, animals would tend to avoid contacts with humans unless attracted by improperly handled garbage disposal or outright feeding by workers. If this occurred, animals, especially bears, attracted to project facilities would likely become nuisances, cause lost work time, damage buildings or equipment, or become dangerous and have to be killed (Section 6.3.1.3).

Animals in winter, especially moose, would tend to use cleared roads, pads, and the airstrip to avoid moving through deep snow. As evidenced on the Glenn Highway in Anchorage, this would significantly increase the chances for animal/ vehicle collisions unless specific operational provisions were made to prevent such occurrences (Section 6.3.1.3).

The habitat evaluation (Table 5-24) indicates that the Lone Creek site occupies high quality bear and spring/ summer/fall moose habitat but is above the elevation of winter moose habitat.

5.6.1.2 Impacts to Freshwater Environments

Hydrology

There would be no significant impact to the groundwater regime as a result of construction and use of the Lone Creek housing facilities and airstrip. Potential groundwater degradation exists from fuel and chemical spills and leaks from sewage treatment facilities. Impacts to the local recharge/discharge relationships would be small.

Before construction of housing facilities begins, a series of diversion ditches and a sediment pond would be constructed which would attenuate the flood peaks and intercept the sediment generated by the disturbed area. Since the disturbed area would be less than 10 ha (25 ac) or 0.04 percent of the drainage area of the Chuitna River, the impacts to surface water hydrology during construction would be negligible.

During the operation phase, the runoff generated by the less than 10 ha (25 ac) of impervious surfaces of the roads, residences, parking lots, and landing strip would be about 3 to 4 times that at present. However, some attenuation would be provided by the sediment ponds. The net impact on the flows and water levels of the Chuitna River would be insignificant.

These facilities would be dismantled, the area regraded and revegetated during reclamation to provide drainage patterns similar to the premining conditions. Therefore, the resulting hydrologic impacts would be minimal.

Surface Water Quality

Runoff from the housing facility construction and operation would be handled using ditches, revegetation, and sediment ponds in the same manner as other site facilities. No adverse effects on water quality are anticipated from the housing project runoff.

Water quality would not be adversely affected by water use or the disposal of treated domestic wastes from the housing facility. The total number of people at the various mine facilities would be 424 during maximum coal production (ACZ 1985c). All personnel would sleep at the housing area, but would work in different locations as follows: 272 at the mine and mine service area, 42 along the transportation corridor, 55 at the port site, and 55 at the housing facilities and airstrip. Since the domestic sewage discharge from the treatment plant at the mine site and the discharge from the housing facility would be at the same location in the Chuitna River and because the port site would have a separate treatment plant discharging to either Cook Inlet or on-site leach field, the effective population discharging to the Chuitna River would be approximately 369. Diamond Alaska indicates in its NPDES permit application that about 94,635 l (25,000 gal) would be discharged to the Chuitna River per day. Historical records of similar facilities suggest that effluent volume might be somewhat greater than indicated in the permit application. About 2.9 kg (6.3 lbs) BOD, 0.6 kg (1.3 lbs) nitrogen, and 0.1 kg (0.3 lbs) phosphorus would be contained within the daily effluent. This discharge could easily be assimilated by the Chuitna River with no adverse impact on water quality (Table 5-27). The sludge effluent generated from the treatment process would be hauled to the mine area for disposal in the ongoing pit reclamation process.

Table 5-27

IMPACT OF DOMESTIC WASTE DISCHARGE ON CHUITNA RIVER

Parameter	Discharge	Chuitna River before mixing	Chuitna River after mixing[1]
Flow, cfs	0.06		30.06[2]
BOD, mg/l	19	est.<2	>2.03[3]
Nitrogen, mg/l	3.9	0.08-0.25	0.088-0.257[3]
Phosphorus, mg/l	0.9	0.01-0.02	0.011-0.022[3]

[1] Increases would all be projected to be less than 10% of background. Mixed flow would meet water quality standards.

[2] Minimum instantaneous.

[3] Maximum concentration during minimum flow.

Biology

Residents of the Lone Creek housing area on the bluffs above the Chuitna River would be likely to sport fish during spare time. If open to fishing, the greatly increased fishing pressure in the 1 to 2 km (.6 to 1.2 mi) of river near the housing site could significantly impact the numbers of coho and chinook salmon reaching their spawning grounds and could significantly reduce rainbow and Dolly Varden populations in that reach which is seldom fished at present. The Chuitna River is currently closed to chinook salmon fishing above the mouth of Lone Creek. If this regulation remains in effect, potential impact on this species would be alleviated.

5.6.1.3 Impacts to Marine Environment

There would be no impacts to the marine environment associated with the Lone Creek housing area and airstrip.

5.6.1.4 Air Quality Impacts

Fugitive dust would be generated during construction of the housing area and the airstrip. During operations, dust would be generated by vehicle traffic. This would be at a lower rate than during construction and could be controlled. Some burning would occur during site clearing, but should be minimal. Air pollution associated with the housing site and airstrip would likely be insignificant.

5.6.1.5 Noise Impacts

The housing site and airstrip would be relatively low generators of noise. Noise would be highest during construction due to heavy equipment, but levels would be lower than the mine or port facility. Tyonek residents should not be disturbed by noise emanating from either the housing facility or the airstrip.

5.6.1.6 Socioeconomic Impacts

Construction and operation of the housing area and airstrip would provide employment for a limited number of people. The primary socioeconomic impacts would result from the mine itself; see Section 5.4.1.6 for a discussion of the expected effects of the project on Anchorage, Kenai, and Tyonek.

5.6.1.7 Effect on Subsistence Resource Harvest

Five potential effects of mine construction and operation on subsistence resource availability and harvest could occur as a result of the Diamond Chuitna project; 1) effects on access to, and use of, customary use areas; 2) changes in fish and wildlife abundance; 3) interference with fish and wildlife life cycles and movements; 4) increased nonresident harvest of subsistence resources, including competition for fish and game with mine employees; and 5) the possibility of increasingly restrictive harvest regulations. Of these, the latter two are most influenced by housing employees at the mine site.

Competition for Fish and Game with Mine Employees

Diamond Alaska has indicated the housing facility would be weaponless and that hunting by workers would be prohibited. Tyonek residents expressed skepticism that this policy would be effective in eliminating hunting by mine workers because of violations of a similar policy at the Kodiak Lumbermill (KLM) in the late 1970s. Nonetheless, assuming that the no hunting policy is effective while workers are on the job, there would likely be an increase in nonresident harvest of moose caused by workers and their friends returning to hunt on their days off. The Lone Creek housing site is less than 0.8 km (0.5 mi) from the Chuitna River; therefore, mine workers would be very likely to sportfish in the Chuitna River if it were open for fishing, especially for king and coho salmon. Increased fishing pressure on these stocks could lead to allocation conflicts. Conflicts between village subsistence hunters and fishermen and non-local hunters and fishermen would increase, especially if the resource base declines.

Effects of Change in Harvest Regulations

Finally, increased harvests of moose or salmon could eventually lead to increasingly restrictive harvest regulations should populations of moose or salmon fall below acceptable levels. This potential effect could be caused by a number of factors, some of which would not be attributable to the Diamond Chuitna Coal Project. However, the cumulative effect of decreased habitat and increased harvest by nonresidents along with external factors such as loss of habitat to other development and increased recreational use of the area by urban residents, could eventually force the Boards of Fish and Game to further restrict Tyonek's harvest of moose and salmon.

5.6.1.8 Impacts to Visual Resources

Impacts to visual resources are expected to be minor when compared to the impact of the mine and mine facilities. The greatest effect would be from the air. This region is considered of moderate visual quality.

5.6.1.9 Impacts to Recreation Resources

A major impact of this alternative upon recreational resources would be fishing by workers in the Chuitna River near the Lone Creek housing site. Over the long term, this fishing pressure could have a significant impact upon the total number of fish available for other recreational fishermen. Increased access to the Chuitna River would also bring additional nonworker recreational fishermen to the area.

5.6.1.10 Impacts to Cultural Resources

No archaeological sites were found in the vicinity of the housing facilities or the airstrip during the baseline resource site survey (Gerlach and Lobdell 1983). The possibility of secondary impacts to cultural resource sites outside the construction areas as a result of increased human presence is expected to be slight.

5.6.1.11 Regional use

The Lone Creek housing site is well located with respect to all three logical mining units within the Diamond Chuitna lease area. Thus, it would probably be used during development and operation of the entire lease area, encompassing a period of several decades. Future major developments within the Beluga region are likely to take place to the north or west of the Diamond Chuitna project area. These developments would likely be at sufficient distances from the Lone Creek site to make its use impractical if it were to remain simply as a worker camp.

5.6.1.12 Technical Feasibility

Adequate technology exists to build both the housing area and airstrip at this location.

5.6.2 Congahbuna Housing Site Alternative

5.6.2.1 Impacts to the Terrestrial Environment

Physiography, Geology, and Soils

Since the design and areal extent of the Congahbuna housing site and airstrip facilities would be similar to the Lone Creek housing site and airstrip, overall impacts in terms of physical site alteration and gravel requirements would be similar.

From the agronomic standpoint, the alternative would primarily involve soils of the Talkeetna Series which closely approximate the soils mapped for the Lone Creek housing facility site. The predictable impacts would, therefore, be similar to those that would result from the Lone Creek site; approximately 29 ha (72 ac) would be disturbed.

Vegetation

Approximately 29 ha (72 ac) of vegetation would be eliminated by clearing for construction of the Congahbuna housing site and airstrip. Although no specific site has been designated, the vegetation of the general location consists primarily of mesic bluejoint graminoid vegetation. No threatened or endangered plant species are known to occur in this area. The loss of this vegetation would not be considered significant.

Wetlands

Direct wetland impacts from construction of the Congahbuna housing site would be nearly identical to the impacts described for the Lone Creek site. The surface area of wetland affected by the Congahbuna housing site would likely be similar to the area that would be affected by the Lone Creek site (Table 5-2). However, the Congahbuna site would be immediately adjacent to wetland areas that receive significant use by waterfowl. Therefore, secondary impacts to wetland values would be significantly greater with this alternative than with the Lone Creek site.

Wildlife

Wildlife impacts due to construction, operation, and reclamation of this option would be the same as those for the Lone Creek site, except that direct habitat loss would occur to wetlands supporting higher levels of waterfowl and shorebird nesting. Unlike the Lone Creek site, however, there would not be an eagle nest within 723 m (2,400 ft) of the airstrip. Considering all factors, the Congahbuna option would probably have greater impacts.

Based on the habitat evaluation analysis (Table 5-24), habitat impacts to the evaluation species for the Congahbuna housing site option would be similar to the Lone Creek option. The Congahbuna housing area could, however, affect one high quality trumpeter swan nesting lake that would not be disturbed with the Lone Creek housing option.

5.6.2.2 Impacts to Freshwater Environments

Hydrology

Impacts to ground- and surface water hydrology resulting from construction, operation and reclamation of the Congahbuna housing site alternative are expected to be minor. Some reduction of inflow to Old Tyonek Creek or Congahbuna Lake may be expected depending on to which water body surface runoff is directed. This reduction would not be significant.

Surface Water Quality

Water quality impacts due to construction, operation, and reclamation of the Congahbuna housing site alternative would be similar to those of the Lone Creek site. However, runoff and discharges from the Congahbuna site would not impact the Chuitna River since it would be routed to either Congahbuna Lake or Old Tyonek Creek.

Site runoff impacts would not be significant. However, discharge of treated domestic sewage from the Congahbuna housing site would have more significant impact than would discharge from the Lone Creek site since the much smaller Old Tyonek Creek would be the likely receiving water. During low flows in Old Tyonek Creek, treated sewage could provide small but measurable increases in BOD, nitrogen, and phosphorus levels although the treated sewage flow would likely be less than 2 percent of the creek flow.

Biology

Construction and operation of the Congahbuna housing site alternative would have somewhat less potential for fishing pressure impacts on the Chuitna River as described in Section 5.6.1.4 for the applicant's preferred housing location at Lone Creek. Limited angling pressure might occur on Congahbuna Lake itself depending on the facility's proximity to the lake; however, unless boat access could be gained, there would be little impact on the lake's fish populations. Impacts on fish populations in other streams would not differ from those produced by the applicant's Proposed Project.

5.6.2.3 Impacts to the Marine Environment

There would be no difference in impacts to the marine environment if the Congahbuna housing site alternative were used as opposed to the Lone Creek site.

5.6.2.4 Air Quality Impacts

Air quality impacts resulting from construction and operation of the Congahbuna housing site alternative would be essentially identical to impacts from the other housing options.

5.6.2.5 Noise Impacts

Noise characteristics and sound levels associated with operation of the Congahbuna housing site alternative would be identical to those associated with the Lone Creek site. Impacts to human and wildlife receptors would also be very similar except that the project housing area would be located further from the mine area and residents of the housing facilities would be less likely to be disturbed by noise generated at the mine site.

5.6.2.6 Socioeconomic Impacts

Socioeconomic effects on Anchorage and Kenai from construction and operation of the Congahbuna Lake housing alternative would be the same as those produced by the Lone Creek alternative.

This alternative would lessen the potential for workers from the Lone Creek housing site in the applicant's Proposed Project to adversely impact fish populations in the Chuitna River. A serious impact to those populations could affect sport fishing guides from Tyonek and possibly commercial fishermen.

5.6.2.7 Effects on Subsistence Resource Harvest

Although construction and operation of any housing site would remove approximately equal amounts of terrestrial habitat and would likely have similar effects on game animals, the Congahbuna site is in an area that is used extensively by Tyonek residents for subsistence activities. Hence, the effects of habitat loss at the Congahbuna site would cause greater impacts on Tyonek's subsistence hunting than would habitat loss at the Lone Creek site. In addition, the road that traverses the Congahbuna site is one of two major overland access routes used by Tyonek residents to reach hunting areas to the west. The design of a housing facility at this site should incorporate provisions for continued use of this road to avoid impacts to subsistence use of the area to the west.

A positive aspect of the Congahbuna housing site alternative would be that the potential for disruption of salmon populations and rearing habitats is far less than at the Lone Creek site. However, Chuitna River chinook salmon stocks comprise a relatively small proportion of the chinook salmon that pass Tyonek beaches each year. For example, Chuitna River chinook salmon escapements represented less than 5 percent of the enumerated Susitna drainage king salmon escapements between 1976 and 1984 (Delaney and Hepler 1984). Hence, the Chuitna River is only a minor producer of Tyonek subsistence chinook salmon. Overall, the Lone Creek housing site would cause fewer impacts to Tyonek's subsistence use of the area than the Congahbuna housing site.

5.6.2.8 Impacts to Visual Resources

Construction, operation, and reclamation of this alternative would have impacts on visual resources similar to those of the Lone Creek alternative. Visual screening potential at both sites is comparable. Although no estimates of use levels are available, the two sites are near reasonably popular recreation sites (Congahbuna Lake and the Lone Creek/Chuitna River fishery). Therefore, visual exposure and user attitudes would be similar.

5.6.2.9 Impacts to Recreational Resources

Construction and operation of this alternative would likely have more negative impacts upon existing sport hunting than would the Lone Creek alternative, but the difference would not be significant because of the relatively limited amount of sport hunting which presently occurs in the vicinity of Granite Point. Since little sport fishing presently occurs in the Congahbuna Lake area, this alternative would cause few negative impacts to existing uses. Further, this alternative would not have as great a potential for adversely affecting sport fishing on the Chuitna River as would the Lone Creek alternative.

Overall, this alternative would have significantly fewer negative impacts to recreational resources than would the Lone Creek alternative.

5.6.2.10 Impacts to Cultural Resources

Aerial and ground archaeological surveys in the Congahbuna area did not locate any cultural resources (Gerlach and Lobdell 1983). As long as construction/operations personnel are informed of the possibility of encountering an archaeological site and the procedures to be followed should they do so, no adverse impacts to cultural resource sites should occur if this alternative were chosen.

5.6.2.11 Regional Use

The impacts of this option would be the same as for the Lone Creek option except that this site would be further from the center of the three logical mining units within the Diamond Alaska lease area, requiring greater transportation costs and job commuting time for workers.

5.6.2.12 Technical Feasibility

Adequate construction technology presently exists to build this alternative.

5.6.3 Threemile Housing Site

5.6.3.1 Impacts to the Terrestrial Environment

Geology, Physiography and Soils

Overall impacts to geology and physiography would be similar to those described for the Lone Creek and Congahbuna sites (Sections 5.7.1.1 and 5.7.2.1). The type of soils likely to be disturbed is unknown.

Vegetation

Detailed vegetation mapping has not been completed for the Threemile housing site. The proposed site is located on upland terrain and dominant vegetation type is probably mixed spruce-birch woodland. Disturbed surface area would be the same as for the other sites.

Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within this area.

Wetlands

No wetland habitats would be affected by development of the Threemile Housing site; consequently, the northern corridor/Ladd port site alternative with the Threemile housing site would have somewhat less wetland impact than would the same corridor alternative with the Lone Creek housing site. However, it is doubtful whether this difference in wetland impact is significant since the Lone Creek site would affect only 2 ha (6 ac) of wetlands.

Wildlife

Adverse impacts from construction, operation and reclamation of this option would be the same as those for the Lone Creek option, except that human activity could cause greater impacts to swans because of the location within a general area frequented by swans during the summer. Unlike the Lone Creek option, however, there would not be an eagle nest within 723 m (2,400 ft) of the airstrip.

The habitat evaluation (Table 5-24) indicates that the Threemile site would affect lower quality moose spring/summer/fall habitat than would the other housing site options; however, the Threemile site would occupy high quality moose winter range.

5.6.3.2 Impacts to the Freshwater Environment

Hydrology

Construction and operation of a housing facility at the Threemile site is expected to have minimal effects on the ground-water regime. Potential degradation of ground-water quality could occur as a result of fuel and chemical spills and leaks from sewage treatment facilities. Impacts to the local recharge/discharge relationships would be small. There would be no significant difference in impacts between the Threemile and Lone Creek housing sites.

It is assumed that, as with the proposed Lone Creek housing site, diversion ditches and sediment ponds would be built before actual construction begins at the Threemile site. This site is located away from any rivers, streams, lakes, or ponds. It borders a small wetland (Section 5.6.3.1). Surface water hydrologic impacts resulting from construction of the Threemile housing site would be minimal and not significantly different from the Lone Creek site.

Surface Water Quality

Runoff from the housing facility would be handled using ditches, revegetation, and sediment ponds. No adverse effects on water quality are expected from the housing area runoff.

Domestic wastes would be treated using secondary treatment. Where this treated effluent would be discharged is unknown at this time. Sludge effluent would be hauled to the mine area for disposal in the ongoing pit reclamation process. Impacts to surface water quality from a housing site at Threemile would not be significantly different from a site at Lone Creek.

Biology

The Threemile housing site is not located within easy walking distance of any streams or rivers. Camp residents would be able, however, to access Threemile Creek, Lone Creek, and Tukallah Lake, among others, by road. Therefore, populations of salmon, rainbow trout, and Dolly Varden in these water bodies could be subjected to heavier fishing pressure. Impacts to aquatic resources would likely be less with housing at Threemile than at Lone Creek.

5.6.3.3 Impacts to the Marine Environment

There would be no impacts to the marine environment associated with construction and use of the Threemile housing site.

5.6.3.4 Air Quality Impacts

Air pollution associated with the housing site and strip is expected to be insignificant and no different housing sites at other locations.

5.6.3.5 Noise Impacts

Noise characteristics and sound levels associated with operation of the Threemile housing site would be identical to those associated with the Lone Creek site. Impacts to human and wildlife receptors would also be very similar except that the project housing area would be located further from the mine area and residents of the housing facilities would be less likely to be disturbed by noise generated at the mine site.

5.6.3.6 Socioeconomic Impacts

Socioeconomic effects on Anchorage and Kenai from construction and operation of the Threemile housing alternative would be the same as those produced by the Lone Creek alternative.

This alternative would lessen the potential for workers from the Lone Creek housing site to adversely impact fish populations in the Chuitna River. A serious impact to those populations could affect sport fishing guides from Tyonek and possible commercial fishermen.

5.6.3.7 Effect on Subsistence Resource Harvest

The Threemile housing site is in an area that is seldom used for subsistence activities and significant impacts on fish and wildlife resources from the site itself would be unlikely. Of the housing alternatives, the Threemile site has the least potential for adverse impact on subsistence activities.

5.6.3.8 Impacts to Visual Resources

The presence of the Threemile housing facilities is expected to have minor effects on visual resources. The site would be visible mainly from the air, it would not be visible from the coast. This area is currently considered to be of moderate visual quality and visual impacts would be similar to those from a Lone Creek housing site.

5.6.3.9 Impacts to Recreation Resources

Workers housed at this site would most likely sport fish on the water bodies crossed by, or near, the northern transportation corridor (Section 5.6.3.2) and pressure on recreational resources in the Threemile Creek/Viapan Lake area could increase. However, the Threemile housing site would be expected to have less impact on recreation than the Lone Creek site because of the latter's proximity to the Chuitna River.

5.6.3.10 Impacts to Cultural Resources

No archaeological surveys have been conducted in the vicinity of the Threemile housing site. The likelihood of cultural resources being found in the area is low.

5.6.3.11 Regional Use

The impacts of this option would be the same as for the Lone Creek option except that this site would be further from the center of the three logical mining units within the Diamond Chuitna lease area, requiring greater transportation costs and job commuting time for workers. It would, however, be located adjacent to the Placer U.S. coal lease (Fig. 4-1) and thus in a very suitable location for use if that lease were developed.

5.6.3.12 Technical Feasibility

The technology exists to build the housing facility as shown.

5.7 CUMULATIVE IMPACTS

The Diamond Chuitna Coal Project would not be built in a pristine area, but one in which resource development and some human settlement has already taken place. Oil and gas exploration and development occurred in the region over twenty years ago, resulting in construction of the Beluga power station, an oil pump station at Granite Point with a pipeline south to the Drift River, and a rudimentary road system north of the Chuitna River along Cook Inlet. In the 1970s, as a result of a state timber sale, a small port was developed at North Foreland as was a road system south and west of the Chuitna River. Several airstrips primarily related to oil and gas development are scattered throughout the region. In addition to the Native village of Tyonek, private land received under federal and state land disposal programs supports several families in the Granite Point and Beluga areas. This project, in providing additional transportation facilities and a residential work camp, would therefore continue the historical process of resource development and introduction of additional people into the region.

Successful operation of the Diamond Chuitna Project would likely make development of other coal and natural resource projects more economically viable because of the increased infrastructure, particularly the port site, it would establish. A working project would also show other potential coal buyers that Beluga region coal can be successfully mined and development of other coal leases such as Center Ridge or Capps would likely be accelerated. These developments would cause significant additional impacts of a nature similar to this project, including additional large mined areas, more roads and airstrips, increased capacity of existing port sites or establishment of new ones, and more people living either in single-status work camps or townsites.

Cumulative impacts to regional hydrology and water quality, especially in the Chuitna River drainage, and resultant impacts to fish populations could be significant. If a worst case scenario is assumed wherein coal mines comparable in size to the proposed project are operated simultaneously on all of the available leases (Figure 4-1) in the area (including the remainder of the Diamond Chuitna lease), then nearly all of the productive northern tributaries to the Chuitna River would be affected to some degree. Streams 2003, 2004, and Chuit Creek would likely be altered substantially. Development of the lease area south of the Capps Glacier would primarily affect the less sensitive Beluga River drainage but could also impact the extreme headwaters of the Chuitna River. Development of the easternmost lease area (Figure 4-1) would affect the headwaters of the two major tributaries to Threemile Creek. In total, these potential stream alterations would probably have a significant adverse impact on regional fish populations. Rearing habitat for coho and chinook salmon in the Chuitna River drainage could be reduced by 40 to 80 percent depending on mining plans and the success of stream reclamation. Spawning habitat for coho, chinook, and pink salmon would likewise be reduced, but to a lesser extent because of the greater use of the mainstem by spawning fish as opposed to rearing fish. At least some of these cumulative impacts would be long-term because of the anticipated difficulty in restoring severely altered stream courses to a productive condition in mined out areas.

Under the same worst case scenario, significant adverse impacts to wildlife would also occur. Multiple mines and transportation systems and extensive human activity would affect the movement of large mammals and would exclude them from substantial areas. After reclamation, habitat value would be less than that which now exists for a substantial period of time. However, in the very long-term, wildlife habitats could be restored more readily than could fish habitats.

Further development in the region, including that from this project, would increase pressures for availability of private land for families that wish to live near their jobs rather than commute from Anchorage and Kenai. A higher population would increase pressure for a permanent road connecting with the State's main highway system. This, in turn, would increase ease of access to the Beluga region, further increasing population.

An increase in the permanent population of the region would require additional services from the Kenai Peninsula Borough, especially schools and roads. More people would result in greater losses of wildlife habitat and increased pressures on fish and wildlife populations and recreational uses of the region. Perhaps the most negative cumulative impacts would be sustained by the villagers of Tyonek who would likely experience significant changes to their traditional social, cultural, and subsistence lifestyles. Such changes could be caused by loss of local governing control, increased drug and alcohol traffic, increased competition for traditional subsistence resources, and loss of Tanaina culture and rural way of life.

On a more specific cumulative impact basis, while the project would meet required air quality standards, it would incrementally contribute to the degradation of Cook Inlet air quality. For example, the increase in marine traffic would roughly double the annual number of larger ships in Cook Inlet.

The project would also provide positive cumulative impacts. Present local residents, particularly those in Tyonek, would have an opportunity to seek year-round employment, thereby providing a stable economic basis for the village. If other developments were spurred by the project, additional employment opportunities would be available. In addition, as regional population growth occurred, the service sector of the economy would provide still other sources of employment and would increase services available to local residents.

5.8 UNAVOIDABLE ADVERSE IMPACTS

Reduction in fish productivity, especially salmon, in the Chuitna River system due to direct habitat loss during mining would be unavoidable during the mine life, for a period thereafter (greater than 10 years), and possibly indefinitely. Complete restoration of streams would not be guaranteed. Terrestrial wildlife species would also be adversely affected by habitat removal during mining but to a less significant extent. Regional movements of large mammals, especially moose and bears, would be partially impeded by the presence of the conveyor system and movement patterns would be locally altered.

Greatly increased human activity in the Beluga region would increase contacts both voluntary and involuntary between residents and nonresidents of Tyonek. Impacts resulting from this could be either adverse or beneficial, although at least a portion of the Tyonek population would be likely to view such impacts as adverse.

5.9 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

In this section, the short-term uses of resources are related to the long-term effects of the project on productivity of those same resources. The purpose is to weigh the project's net benefits to residents of the project area, the region, and society as a whole. In general, short-term uses would be those which would occur during the lifetime of the project. Long-term productivity would generally refer to the time beyond the life of the project.

The estimated mine life for the proposed project is 34 years. Additional probable coal reserves exist within the Diamond Chuitna lease area and within other leases nearby. There is a reasonable probability that these reserves will be developed subsequent to completion of mining within the limits of the Proposed Project if market conditions are favorable. Therefore, the short-term exploitation of coal resources may well lead to longer term coal productivity.

Many of the impacts discussed earlier in this chapter would be considered short-term, with many of the greatest impacts occurring during the initial construction and early operational phases of the project. If these impacts were properly mitigated as discussed, adverse impacts on productivity would be primarily short-term. The goal of post-mining reclamation would be to return the area to a level of productivity for wildlife and fish which is at least as great as that which existed prior to mining. In view of the analysis presented in Sections 5.3.2.2 and 5.3.2.4, it would appear unlikely that fish productivity in streams directly disturbed by mining could be restored to premining productivity levels. Restoration of wildlife productivity would likely occur over the very long-term; however, such restoration could require up to 40 years postmining.

The increase in economic activity, influx of new residents from outside the region, and other pressures associated with increased human populations in the short term could have a significant long-term impact upon existing regional social and cultural traditions and values. For example, the short-term benefits of project employment might have long-term indirect impacts upon traditional subsistence lifestyles. Increasing dependence upon the cash economy caused by project employment could lead to a lessening of participation in the subsistence lifestyle. While this would not necessarily be bad, at completion of the project, families may have become so dependent upon the cash economy that they would be unable to fully readapt to the subsistence lifestyle if other types of employment were not available.

5.10 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A decision to permit the Diamond Chuitna Coal Project and its subsequent construction and operation would irreversibly and irretrievably commit several resources.

At least 330 million short tons of coal would be removed and ultimately consumed as fuel for various needs over the life of the mine. Gravel resources would be mined and used for various project facilities. While the gravel would remain in the vicinity, it would not be practical in most cases to recover it for other future uses or return it to its sources.

The extraction, transportation, and processing of the coal would require a large commitment of energy resources (diesel oil, gasoline, natural gas, etc.) which would be irretrievably consumed. However, the energy gained from the coal would greatly exceed the energy consumed in acquiring the coal.

The soil lithology and geological structure beneath the mine area would be irreversibly altered. Postreclamation topography, while similar to the premining condition, would also be altered. Vegetation, wildlife habitats, and fish habitats would be different from the original condition but not necessarily less valuable or productive, depending on the success of reclamation. The analysis in Section 5.3.1.2 suggests that fish habitat could be irretrievably lost. Production of fish would be reduced in the Chuitna River drainage during mine operation and for a period thereafter and would constitute an irretrievable loss as described in Section 5.3.1.2.

Some hunting, fishing, and other recreational and subsistence opportunities would be irretrievably lost for the life of the mine and probably for a substantial period thereafter.

6.0 MITIGATION, RECLAMATION, AND MONITORING

6.1 INTRODUCTION

The term "mitigation" can have several meanings in an EIS process:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(e) Compensating for the impact by replacing or providing substitute resources or environments or by enhancing the value of an existing environment.

Mitigation by avoiding impacts altogether, as in (a) above, was incorporated extensively throughout the EIS process through elimination or alteration of options or designs to avoid significant effects (Chapter 3.0). Minimizing impacts, rectifying impacts through repair, and eliminating impacts over time, are the forms of mitigation employed extensively by Diamond Alaska in its planning for the Proposed Project.

Mitigation and reclamation measures proposed by Diamond Alaska as part of the Proposed Project have been described in Chapter 2.0. The discussion of environmental consequences in Chapter 5.0 has taken these proposed measures into account. This chapter describes selected mitigation and reclamation options other than (or in addition to) those proposed by the applicant. Specific mitigation or reclamation procedures or combinations of procedures could be required of the applicant as stipulations to permits and, thus, are among the alternatives available to the agencies as described in Chapter 3.0. This chapter first discusses general concepts relating to mitigation and monitoring in the context of the environmental regulatory process as applied to the Diamond Chuitna Coal Project and then focuses on specific mitigation options that address concerns raised during the scoping process and subsequent agency responses. The environmental consequences and overall feasibility of implementing the measures are then briefly described. Monitoring programs that may be needed to determine the need for and effectiveness of mitigation and reclamation and to determine actual project impacts are also discussed in this chapter.

6.2 MITIGATION CONCEPTS

The mitigation measures discussed in this chapter are presented as options available to regulatory agencies to utilize in their respective permitting processes. For reasons discussed below, it is not considered feasible at this time to develop a comprehensive project mitigation plan for the entire, 34-year life of the project. Likewise, it is not the EPA's intent to dictate to other agencies stipulations they should include in their permits. However, EPA does have an obligation under NEPA and the CEQ regulations to discuss appropriate mitigation measures not already included in the proposed action or alternatives [40 CFR 1502.14(f)]. To that end, this chapter is devoted to providing a "menu" of mitigation options which could be applied by various agencies (see Section 7.3) during the current and ensuing permitting phases. Many of the measures presented here will be addressed in more detail by the agencies as part of their respective permitting processes. In particular, ADNR, as part of the Alaska Surface Coal Mining Permit Program (11AAC 90.311), has conducted a very thorough review of such issues as topsoil segregation, reclamation, and hydrologic balance. Readers are encouraged to contact ADNR's Division of Mining for information related to the Alaska Surface Coal Mining Program (see page 7-7).

From the standpoint of environmental regulatory processes, the Diamond Chuitna Coal Project has a number of features that are somewhat different from other large projects that have been reviewed in Alaska. Because of the duration of the project and the nature of the environment, impacts would be distributed over a substantial period with some of the more significant impacts occurring near the end of the mine life. This contrasts with other kinds of projects (e.g. petroleum development) where impacts are normally greatest during the construction phase and decrease thereafter. The prolonged impact period provides some special problems for the permitting agencies especially in planning and administering mitigation programs. In addition, the existence or severity of many of the impacts cannot be accurately predicted in advance. For these reasons, it is not feasible to develop project specific mitigation plans for the total life of the project.

There appears to be substantial agreement among the regulatory agencies that emphasis for the time being should be on developing (1) a mitigation plan for the first phase of permits (i.e., the first eight years) and (2) a monitoring program to detect actual impacts over the 34-year life of the project. Subsequent mitigation requirements could then be imposed in later permitting phases when impacts are expected to be more severe to minimize or compensate for observed rather than predicted impacts. Also, certain innovative mitigation techniques could be tested in the early years of the project to evaluate their effectiveness.

The USFWS Mitigation Policy Statement for the Diamond Chuitna Coal Project (Appendix B) will serve as a guide to assessing the adequacy of proposed mitigation measures relative to biological impacts. This document identifies key species, habitat value criteria, and mitigation goals.

6.3 PROJECT-SPECIFIC MITIGATION/RECLAMATION OPTIONS

6.3.1 Terrestrial Environment

6.3.1.1 Soils

Diamond Alaska originally proposed that topsoil not be segregated from overburden and that overburden be used as top dressing to provide a base for revegetation rather than using native topsoil. This procedure differs from the normally accepted practice of stockpiling topsoil for later use during reclamation of the ground surface. Concern was expressed during scoping regarding the need for topsoil segregation and stockpiling. Therefore, separate topsoil handling has been considered as a mitigation/reclamation option. Under this option, topsoil, or at least selected portions of it, would be salvaged during initial stripping and then replaced on the soil surface during reclamation as a base for revegetation.

Replacing native topsoil prior to revegetation would have several advantages over the use of mineral overburden soils:

- Organic matter present in topsoil would help prevent soil compaction and crust formation and would hold moisture; all of which are beneficial to plant growth.

- Topsoil contains valuable microflora as well as being a valuable source of plant propagules (seeds, rhizomes, bulbs, corms); topsoil use would accelerate the invasion of native species.

- Soil permeability and runoff characteristics would more nearly approximate premining conditions and, thus, postmining hydrology would likely be more similar to the premining state.

Topsoil use could also have some disadvantages:

- Topsoil could be more erodible than selected overburden soils and, thus, contribute to stream siltation.

- Heavy concentrations of peat would create acidic soils and poor growing conditions.
- Stockpiling topsoil would involve substantial additional surface disturbance.
- Separate handling and stockpiling of topsoil would involve a separate excavation and trucking step and, thus, would add substantially to the cost of mining.

The ADNR has conducted a detailed analysis of the feasibility of substituting overburden for topsoil as part of their review of Diamond Alaska's surface mining permit application. The Alaska Surface Coal Mining Program requires the use of topsoil unless the following substitution requirements can be met:

> "Selected overburden materials may be substituted or used as a supplement to topsoil if the operator demonstrates to the commissioner that the resulting soil medium will be as suitable for sustaining revegetation as the available topsoil and that the substitute material is the best available to support revegetation. This demonstration must be based upon analysis of the thickness of soil horizons, total depth, texture, percent coarse fragments, mineralogy of the fine earth fraction, chemistry, pH, and areal extent of the different kinds of soils. The commissioner will, in his or her discretion, require other chemical and physical analyses, field-site trials, or greenhouse tests determined to be necessary to demonstrate the suitability of the topsoil substitute or supplement". (11AAC 90.313).

The ADNR review included a detailed technical analysis of the physical and chemical properties of soil and overburden in the project area in relation to vegetation requirements. The ADNR Notice of Decision (ADNR 1987) denied Diamond Alaska's request for a variance from the topsoil regulations and included a stipulation that a topsoil salvage and handling plan must be prepared for ADNR review and approval prior to permit issuance.

In response to ADNR's request, Diamond Alaska prepared a topsoil handling plan that incorporates salvage of selected topsoils (Strandline sandy loam) and redistribution of topsoil six inches deep (average) over the regraded overburden within reclaimed areas. Stockpiling of topsoil would be employed where necessary but would be minimized.

Topsoil handling, as currently planned, would adequately satisfy the needs of the revegetation program and is considered a valuable mitigation measure.

6.3.1.2 Vegetation

ADNR, through its review of Diamond Alaska's surface mine permit application, has conducted a detailed technical analysis of the applicant's proposed revegetation program for the first 10 years of mining. Diamond Alaska's plan was approved with some stipulations regarding minimum plant density.

The revegetation program proposed by Diamond Alaska is ambitious and involves a variety of techniques. The EIS team supports the proposed range of techniques, but has minor concern over particular aspects of the plan. Experience on other projects within Alaska (e.g. Trans Alaska Pipeline) suggests that replacement of woody plant species using nursery stock could have inconsistent and unpredictable results (Hilliker 1985) . The existing plan relies fairly heavily on a landscaping approach to create a mosaic of pre-planned vegetation community types. An additional problem with the landscaping approach concerns the fact that soil moisture (which would reflect postreclamation groundwater levels and permeability) cannot be accurately predicted and might not correspond with the requirements of proposed plant communities. In light of the above, an approach to revegetation which relies more heavily on the encouragement or acceleration of natural plant succession* in combination with the more structured landscaping approach is being suggested as an option for consideration in this EIS. Some suggestions for possible plan revision are presented below:

- Increased emphasis on acceleration of reinvasion of natural species by utilizing fertilizer treatment, especially in rehabilitated areas adjacent to existing natural terrain
- Increased emphasis on creation of islands of natural vegetation throughout the site to serve as sources for reinvasion
- Increased emphasis on establishment of willows rather than alders in selected areas
- Decreased emphasis on the use of non-native species
- Increased emphasis on topographic diversity (including pond creation) to enhance vegetation diversity
- Increased emphasis on the maintenance of flexibility in designing revegetation plans to respond to actual postmining conditions of topography, soil moisture, and soil composition

6.3.1.3 Wildlife

Minimizing disruption of wildlife habitats and assuring successful reclamation represent major issues identified during the scoping process. As indicated in Section 5.3.1.5, postmining habitat values would probably be somewhat lower for at least some key species (moose and black bear) than exist in the premining condition. This loss of habitat value would continue for a period of time after mining until natural plant succession could supply the diversity and floristic composition needed to optimize value. Reclamation measures that enhance habitat value and reduce the amount of time required to attain stable plant communities suitable as high quality moose and black bear habitat could be implemented as part of the reclamation plan. Essentially, these measures would assist natural successional processes. Optional measures or changes in emphasis that could be considered include:

- Provision of a more diverse topography that would include wet depressions
- Development of a community-oriented revegetation plan based on actual postmining topography, moisture regime, and other ecological criteria
- Increased emphasis on the use of native species from "sod" or "pads" that are salvaged and stored during clearing; pads would be redistributed to serve as a colonizing seed source (berry-producing species, e.g., *Vaccinium*, *Sambucus*, *Rubus*, *Viburnum*, and *Ribes* are suggested for inclusion in these pads as often as feasible)
- Increased emphasis on the diversity of native species in seed mixes; consider the addition of alpine bluegrass, slough grass, yarrow
- Increased emphasis on rapid establishment of shrub communities by sprigging, to supplement establishment from transplant pads
- Increased emphasis on application of follow-up fertilizer to sustain species, growth, and assist native recolonization until natural nutrient recycling is established
- Increased emphasis on development of "edge" habitats

Diamond Alaska has committed to the reestablishment of habitat in the mined area comparable in wildlife value to premining conditions. Performance standards could be established to provide a gauge for determining if and when the goal of equal value has been reached. Such standards could be based on habitat utilization models for key wildlife species, on actual wildlife use as determined through monitoring, or on a combination of the two. The standards should be objective so that the applicant's responsibilities are clearly defined.

Habitat enhancement is being considered as a mitigation option in this DEIS to compensate for irreversible or long term commitments of valuable wildlife habitats. The nature of such compensation would be developed in conjunction with the regulatory agencies.

A prohibition of animal feeding could be strictly enforced. The ADF&G regulation prohibiting such feeding (5 AAC 81.218) could be posted conspicuously throughout the camp. All workers could receive environmental training which would stress the importance of this prohibition, the usual consequences to the animals themselves from being fed, and the potential danger to humans.

Drivers could be made aware of the potential for collisions between moose and vehicles along the haul road. Before construction begins, measures could be developed to minimize the possibility of collisions. The applicant plans to clear vegetation for a distance of between 7.9 m and 15.2 m (25 and 50 ft) from the edges of road surfaces to discourage feeding and increase visibility. In moose concentration areas (e.g., at conveyor crossings), reduced speed limits could be used at dusk and dawn. Additional precautions might include continual clearing of snow from road surfaces and for a sufficient width to permit moose to use the road shoulders rather than compete with vehicles for the road surface itself. Snowblowers could be used to eliminate deep snow berms. On steep or blind curves, lighting could be installed. In the event of collisions, procedures for reporting to ADF&G and salvaging the meat could be established.

Before construction begins, plans could also be developed for dealing with nuisance animals. Measures for handling all situations from removing animals which have wandered into a work area to dealing with dangerous animals could be included in the plan. Trained personnel with proper equipment for animal removal could be available at all times. ADF&G would be apprised of any situations involving animals which may arise during construction or mine operation as required by regulation.

In areas where power lines or support cables are higher than surrounding trees or where they cross natural bird movement corridors, large plastic balls could be suspended from the wires or cables so birds would be aware of their presence and avoid flying into them. In particular, the cables supporting the conveyor over the Chuitna River canyon (if constructed) could be equipped with such balls as could the power lines crossing the river at the haul road bridge. Cables and transmission lines could be routed to conform to natural topography and suspended below treetops to the greatest extent possible.

To minimize disturbance of eagle nest trees, construction of roads or other facilities could be avoided within 100 m (110 yd) of the trees between March 1 and July 1. This standard buffer is used by USFS and USFWS in southeast Alaska. If eagles have not nested and laid eggs at the site by May 15, construction could begin. A 457 m (1,500 ft) vertical and horizontal exclusion zone for helicopters could be established around the eagle trees from March 1 through May 15. If nesting did occur, the exclusion zone could continue until September 1.

6.3.2 Freshwater Environment

6.3.2.1 Hydrology

Maintaining the hydrological integrity of the Chuitna River system is a substantial concern and was identified as one of the primary issues during the scoping process especially relating to protection of fish habitats. As described in Chapter 5.0, significant short- and long-term alterations to hydrological characteristics would result from the proposed project. To protect fish resources, two general goals of mitigation would be: 1) to assure adequate flow in the affected Chuitna River tributaries during the period of disruption and 2) to restore hydrologic balance and stream integrity as quickly as possible after mining.

Mine operation would involve development of a complex system of drainage control including peripheral drainage ditches, sediment ponds, and mine pit dewatering. The surface and ground water captured by the mine drainage would represent a loss to the annual flow of several streams. To accomplish the first goal described above, it would be necessary to continuously return the water accumulated by the mine drainage to the affected streams in approximately the same proportions as it was removed. Under current project plans, water releases would necessarily be tied to the settling pond systems and discharge would normally be to the most easily accessible drainages. Allocation of return flows to optimize downstream flow conditions is, therefore, proposed as an optional mitigation measure for consideration by the permitting agencies. Such allocations would be complex, especially in the later years of mining when three streams would be affected. Decisions regarding allocation of return water to the various streams would involve impact tradeoffs and would consider the protection and/or optimization of fish habitat (see Section 6.3.2.3). There are some serious questions regarding the technical and economic feasibility of a water allocation system. Extensive use of pipes and pumps to distribute water would be difficult in winter and subject to freezing and breakdown. There is no assurance that sufficient unfrozen water would be available in the winter in the mine pit to supplement stream flows; consequently, some form of water storage might be needed to meet target flows in the winter. The system would need to be continually modified to accommodate mine expansion and would add substantial cost.

One of the keys to accomplishing the second goal (restoring hydrologic balance) would be to restore ground-water equilibrium within the mined out area as quickly as possible so that the affected streams would again receive a full baseflow. Opportunities for accelerating recharge would be limited since recharge rate is dependent on annual precipitation. However, mitigation measures that would minimize surface runoff from the area and promote percolation of water into the soil would speed recharge somewhat. The creation in the reclaimed area of isolated depressions (similar to bog ponds that now exist) and impoundments connected to surface drainage systems would aid this process and is, therefore, being considered as a mitigation option. The above measure would be relatively inexpensive and would be consistent with recommendations relative to wildlife habitat restoration.

Restoration of mined-out stream systems to conditions similar to premining is a stated goal of Diamond Alaska and, if successful, would minimize net loss of fish habitat. Recreation of premining hydraulic conditions is probably not feasible because of the extreme sinuosity of portions of streams within the mine area and because stream channels are currently confined by matted organic materials that are resistent to erosion. Feasible hydraulic criteria could be adopted for planning reclaimed streams that would supply physical conditions suitable as fish habitat and minimize hydraulic instability. A mitigation option proposed for consideration is the careful design of reclaimed streams involving an integrated effort of hydrologists and fish habitat specialists. The output could include specifications for bed and bank materials, gradient, sinuosity, depth, riffle-pool ratio, etc.

6.3.2.2 Surface and Ground-water Quality

Concern was expressed during scoping regarding the quality of water running off or leaching through coal storage piles. Leaching tests (Bookcliffs 1985) suggest that the water quality would be relatively high and, consequently, Diamond Alaska does not plan to install an impermeable liner under the coal stockpiles at the mine service area or port site. Installation of such liners is being suggested as an optional mitigation measure to prevent the remote possibility of ground-water contamination and as a contingency against the possibility that coal from untested portions of the mine could contaminate water to a greater degree than the existing tests indicate. An impermeable liner could have the potential detrimental effect of increasing the amount of contaminated surface runoff collected by perimeter drainage systems. This situation would require additional treatment measures before the water was ultimately discharged to surface waters. The use of impermeable liners is technically feasible but would represent a substantial expense.

Mitigation measures for possible sediment or metals contamination from pit discharge or sediment pond discharges cannot be fully determined at this time. It is not known what the actual levels of discharges will be, what the specific impacts will be, or to what level additional treatment may be required to mitigate impacts to aquatic life. Precipitation, flocculation, and settling have been discussed as planned mitigation measures. Tests of representative samples have been made to determine the potential extent of the sediment problem and the impact of polymer flocculation on settling efficiency. Initial test data look promising. Diamond Alaska has tentatively concluded that flocculation and settling will suffice to treat discharges to required levels. Treatment methods beyond precipitation, flocculation, and settling are complex and would be costly to operate in such a large mobile project and during the cold weather conditions. Options such as filtration or winter storage are the logical next steps. However, they should not be considered as potential mitigation measures without proof of need, since the consequences of implementation would be significant to project economics.

6.3.2.3 Biology

Physical changes to the Chuitna River drainage and resulting adverse impacts to fish resources represent one of the major issues identified during the scoping process. Adverse impacts to fish, especially salmon, have been identified in Chapter 5.0 as one of the more significant potential project effects. Impacts would include temporary loss of rearing and spawning habitat for coho and chinook salmon because of direct impacts during mine development (Table 5-14) and probably a net loss of these habitats in the long-term because of difficulty in restoring streams that have been mined through. Because of the significance of these impacts and the interest expressed by regulatory agency representatives, a workshop was held on August 20, 1985, to discuss impacts to aquatic resources, mitigation options, and monitoring needs. Most of the following discussion is based on the results of that workshop.

Diamond Alaska has proposed a variety of mitigation measures for the first 10 years of mining to protect fish habitats, assure adequate restoration, and minimize impacts in those areas where some impact is unavoidable. The range of measures proposed by Diamond Alaska was generally considered adequate within the context of the relatively minor impacts that would occur during the early years of mining with the following important provisions: a monitoring program should be in place to determine the effectiveness of mitigation and performance standards should be developed by which to judge this effectiveness. It was generally agreed that immediate development of a detailed mitigation plan to compensate for impacts occurring beyond the first eight years was not reasonable at present because the impacts to aquatic resources cannot be accurately predicted. Therefore, the emphasis was placed on developing a mitigation plan for the first eight years of mine operation and developing an adequate monitoring program so that the effectiveness of ongoing mitigation measures could be evaluated and actual project impacts could be identified.

Performance standards, by which to judge the effectiveness of mitigation or the need for compensatory mitigation, are considered by some agencies to be important elements of mitigation strategy. To achieve a goal of no net loss of habitat or fish production, a combination of the following standards might be used to recognize when and where an impact is occurring, to quantify its influence, and to mitigate accordingly.

- Instream flow relationships and requirements among various evaluation species (chinook, coho and pink salmon, and rainbow trout)
- Numbers of fish normally produced by the affected stream system
- EPA and/or State of Alaska water quality standards

Net loss of fish productivity would be unavoidable during mine operations and afterward. Therefore, compensation through enhancement of existing aquatic habitats or creation of new habitats might be considered as an option. Compensatory mitigation measures and their feasibility in the project vicinity were discussed at the aquatic habitat workshop and a list of options was derived from which measures could be selected as appropriate:

- Creation of stream access to existing ponds or lakes; this could be combined with deliberate introduction of fish (e.g. sockeye salmon) or without fish introduction
- Creation of new ponds within mined or unmined areas
- Incubation of eggs in incubation boxes within selected portions of the Chuitna River drainage
- Creation of spawning and incubation channels through enhancement of existing Chuitna River side channels

- Beaver control and/or dam removal; this may have marginal value as a permanent mitigation measure because of habitat tradeoffs

- Annual removal of stream blockages (including beaver dams) as directed on an as-needed basis by a professional fishery biologist

- Lake fertilization; appropriate bodies of water may not be available in the project area

- Installation of fish ladders to increase range of fish movements in the Chuitna drainage (workshop participants were not aware of any obvious potential for fish ladder use)

- Optimization of stream habitat via flow allocation; technical and economic feasibility may be limited

All of the above mitigation options would require detailed site-specific evaluations to determine optimum locations for mitigation sites. A study of compensatory mitigation opportunities in the Chuitna River watershed should be conducted during the first two years of mine site preparation to allow the development of a detailed mitigation plan prior to the time when habitat losses might occur. Such an approach would be consistent with the statutory responsibilities of ADF&G relative to the issuance of Fish Habitat Permits per Alaska Statute 16.05 as well as the goals of Appendix B. Detailed mitigation planning could be phased to correspond with the permit terms dictated by the Alaska Surface Coal Mining Control and Reclamation Act.

Many complex decisions possibly involving impact tradeoffs would be required over the mine life. Successful implementation of mitigation and restoration measures would require a concerted effort by well-informed persons. A mitigation option being considered in this EIS is the formation of an aquatic habitat committee consisting of agency and industry personnel to review conditions and provide recommendations regarding mitigation details. Committee members could be selected on the basis of professional qualifications as well as long-term commitment to the project to assure consistency of input. Decision procedures and channels of communication would need to be well defined to avoid unnecessary delays and to allow timely resolution of key issues. Such a committee would tend to minimize impacts by providing the best professional advice on how to maximize the effectiveness of the mitigation opportunities available.

6.3.3 Marine Environment

Pile driving and other highly disruptive in-water activities that might be required for trestle construction could be discontinued during the peak periods for chinook and sockeye salmon migration to minimize adverse impact on set net fisheries and on the fish themselves.

6.3.4 Socioeconomic Aspects

The scoping response indicated considerable concern on the part of Tyonek residents that they have the opportunity to reap some benefit from the project to offset some of the adverse impacts that might occur to Native lifestyles and traditional subsistence resources. Programs by the applicant to promote employment of Tyonek residents, to enhance the quality of life in other ways, and to generally establish good relations between the mine development organization and the village of Tyonek might be appropriate and desirable.

6.3.5 Cultural Resources

Baseline studies did not examine all project facility sites in detail for antiquities and historic resources because not all facilities locations were clearly identified at the time of the studies. Therefore, additional surveys could be conducted prior to construction when project siting is definitely established. If significant resources are discovered within areas proposed for development, the location could be adjusted to avoid the site or the site could be examined and cleared using a methodology approved by the State Historic Preservation Officer.

6.4 MONITORING

The following is a brief description of the kinds of monitoring programs which may be appropriate in view of the issues identified during scoping and the impact potentials discussed in Chapter 5.0. It should be noted that Diamond Alaska has proposed several programs in its Surface Mining Permit Application that correspond to some of the monitoring suggestions given below. In addition, ADNR, through their detailed technical review of the surface mine permit application, has evaluated the kinds of monitoring programs that might be needed to address their concerns. The monitoring suggestions presented in this DEIS are intended as guidelines for the permitting agencies and are not intended to be a definitive monitoring plan.

6.4.1 Terrestrial Environment

6.4.1.1 Soils

The chemical and physical characteristics of overburden and interburden could be selectively monitored during mine operation to test the accuracy of premining predictions relative to its potential for providing a suitable growth medium for revegetation and its generally low potential for generating toxic leachates.

6.4.1.2 Vegetation

Regardless of which revegetation approach is employed, long-term monitoring of reclamation success would be essential to determine if the goals were being satisfied. Periodic visits by reclamation specialists might be appropriate during the growing season starting in permit year 3 or 4 (rehabilitation of the overburden stockpile), continuing through the life of the mine, and for a specified period afterwards.

6.4.1.3 Wildlife

Monitoring programs to determine the following could be designed and implemented:

- Success of the large animal crossings in passing big game across the conveyor (additional information may need to be collected before project construction begins to establish baseline corridor crossing frequency)
- Effects of mining activities on use by moose of the rutting area which adjoins the mine site
- Documentation of all nonhunting mortality of important wildlife species caused by mining-related activities (e.g., animal/vehicle collisions, falling into pit, drowning in sediment ponds)
- Wildlife use of reclaimed habitats (when sufficient reclaimed terrain is available)

6.4.2 Freshwater Environment

6.4.2.1. Hydrology

Continuous flow monitoring for the life of the mine and for a period thereafter could be conducted at selected stations on Lone Creek, streams 2003 and 2004 and the Chuitna River within the zone of impact. In addition, control reaches upstream of the impact zone could be monitored to allow separation of natural and project-related phenomena.

The relative contributions of ground and surface water to streams could be examined during various phases of mine development and reclamation.

Ground water could be monitored via wells both upgradient and downgradient from the mine to provide background aquifer data and to detect contamination from mining. Ground-water recharge within the overburden aquifers could be monitored during mine reclamation.

6.4.2.2 Water Quality

Water quality of effluents from drainage systems associated with the mine, port facilities, and housing area, as well as at selected stations in receiving streams, should be periodically monitored for the life of the mine and a period thereafter per the monitoring requirements of the NPDES permit (Appendix C).

6.4.2.3 Biology

Monitoring requirements were discussed in substantial detail at the aquatic habitat workshop and there was at least partial agreement that monitoring for aquatic habitat impacts could include the following elements:

- Measurements of water quality downstream from the mine area (in addition to NPDES requirements); this should include sedimentation evaluations

- Continued collection of flow and other hydrological data during operation and post-project to allow existing instream flow models to be rerun to predict theoretical habitat changes

- Collection of flow and other hydrological data in designated control streams or reaches unaffected by mining to allow separation of project-induced effects from natural phenomena

- Fish evaluations to include:

    - Spawner surveys (salmon)
    - Smolt outmigration at affected tributary mouths
    - Rearing density in affected tributaries

- Photographic documentation of natural events, e.g. aufeis formation, breakup phenomena, etc.

- Other monitoring as necessary to test the effectiveness of specific mitigation measures, e.g., fish utilization of created habitats, etc.

Most monitoring could be initiated at the time when impacts begin to affect streams and continue on an annual basis. Frequency could be reduced in future years if the data suggest that less frequent monitoring would adequately assess impacts and/or reclamation success.

6.4.3 Marine Environment

Commercial fishing success near the port area could be monitored in cooperation with ADF&G after trestle construction. Monitoring could be continued for at least 3 years to detect whether the port facilities affect fishing success.

6.4.4 Air Quality

The generation and transport of dust and other particulate emissions created by various project activities should be monitored with emphasis on potential impacts to centers of human habitation. Primary emphasis should be placed on fine particulate matter (PM-10) and visibility impacts on the Tuxedni National Wildlife Refuge (Class I airshed).

6.4.5 Socioeconomic Aspects

Ongoing coordination with Tyonek community officials could identify project-related social, cultural, and economic problems as they might develop.

6.4.6 Subsistence and Recreation

Periodic monitoring of postproject subsistence and recreation use patterns and success rates could detect project-induced changes.

7.0 CONSULTATION AND COORDINATION

7.1 INTRODUCTION

A designated purpose of an EIS is to actively involve regulatory agencies and the public in the decision making process. EPA conducted a broad public and interagency consultation and coordination program throughout development of this EIS. Input was solicited from the beginning of the project and this input has been incorporated into the document. Specific public and agency involvement is described below.

7.2 SCOPING

The scoping process conducted by EPA provided an opportunity for members of the public, special interest groups, and agencies involved in the EIS process to assist in defining significant environmental issues. Main objectives of these scoping meetings were to:

- present an overview of the proposed Diamond Chuitna Coal Project;
- identify the major environmental issues to be addressed in the EIS;
- identify areas where additional information was needed;
- receive comments and questions regarding environmental impact concerns; and
- incorporate those comments and questions into the EIS planning process.

The formal scoping meetings and the approximate number of persons in attendance were as follows:

Date	Location	Attendance	Participants
Jan. 8, 1985	Anchorage	17	State & federal agencies
Jan. 8, 1985	Anchorage	80	Public meeting
Jan. 9, 1985	Soldotna	20	Public meeting
Jan. 10, 1985	Tyonek	27	Public meeting

In addition to the formal scoping meetings, the following prescoping meetings were held to provide information about the project and solicit questions and comments:

Date	Location	Attendance	Participants
Dec. 11, 1984	Anchorage	16	State & federal agencies
Dec. 12, 1984	Anchorage	2	Alaska Center for the Environment; Trustees for Alaska

The oral and written comments and questions received during and following the scoping meetings were documented in a Responsiveness Summary (EPA 1985). Its purpose was to provide a public record of the issues and concerns raised, to provide a response to those issues and concerns, and to serve as a blueprint for the EIS process to follow. A summary of the comments received at the scoping meetings and from written responses is shown in Table 7-1.

7.3 AGENCY INVOLVEMENT

Because of the size and nature of the project, several federal, state, and municipal agencies have been involved in the EIS process. These entities and their major responsibilities are listed below:

Federal Agencies

- U.S. Environmental Protection Agency: The EPA is the lead federal agency for the Diamond Chuitna Coal Project and has responsibility for preparation of an EIS that meets National Environmental Policy Act (NEPA) requirements. Additionally, EPA has responsibility for issuing National Pollutant Discharge Elimination System (NPDES) permits for wastewater discharge. EPA must also concur on issuance of a Section 404 permit (see U.S. Army Corps of Engineers below).

- U.S. Army Corps of Engineers: The Corps is a cooperating agency for the EIS and has responsibility for issuing Section 404 wetlands and Section 10 navigable waters dredge and fill permits.

- U.S. Fish and Wildlife Service: The USFWS has responsibility for certain threatened and endangered species and has advised and consulted with other federal and state agencies on fish and wildlife issues.

- National Marine Fisheries Service: The NMFS has responsibility for certain threatened and endangered species and has advised and consulted with other federal and state agencies on anadromous, marine, and intertidal fish and marine mammal issues.

TABLE 7-1
(continued)
MATRIX OF COMMENTS RECEIVED FROM SCOPING MEETINGS AND WRITTEN RESPONSES

	Comment Sources																Summary	
	Meetings				Written Comments												Number	
	Agencies	Anchorage public	Soldotna public	Tyonek public	Public	Environmental groups	Other groups	Fish & Wildlife Service	EPA	Nat'l Park Service	Adv. Coun. Hist. Pres.	Corps of Engineers	Dept. Nat'l Res. (Parks)	Dept. Fish & Game	Dept. Environ. Cons.	Diamond Alaska Coal Co.	Comments	Sources
7. Drainage control and wastewater treatment	1					7		4	3					2	2		19	6
8. Sewage & solid waste disposal					2			2									4	2
9. Soil erosion/ stabilization		1	1	1	1	2											6	5
10. Blasting								1	1					1			3	3
11. Fuel/reagent spills					1			2							1		4	3
12. Herbicides								1									1	1
13. Borrow sources								1						1			2	2
14. Dust control					7			2									9	2
15. Noise					3												3	1
16. Economics		3			1											1	5	3
17. Technical feasibility																1	1	1
18. Reclamation	4		2	1	3	1		2	1			1		4			19	9
19. Mitigation	3					2	1		3			1					10	5
20. Monitoring	1		1	2	2	1			1								8	6
E. EIS PROCESSES																		
1. Generally applicable comments					5	1	1			1	2	2	1				13	7
2. Baseline data presentation	2							2	2								6	3
3. Cumulative impacts		2	1			2		1									6	4
4. Tiered EIS								1									1	1
5. Alternate energy sources analyses		1	1			2											4	3
6. Regional perspective		1	1			1											3	3

TABLE 7-1

MATRIX OF COMMENTS RECEIVED FROM SCOPING MEETINGS AND WRITTEN RESPONSES

	Comment Sources																Summary	
	Meetings				Written Comments												Number	
	Agencies	Anchorage public	Soldotna public	Tyonek public	Public	Environmental groups	Other groups	Fish & Wildlife Service	EPA	Nat'l Park Service	Adv. Coun. Hist. Pres.	Corps of Engineers	Dept. Nat'l Res. (Parks)	Dept. Fish & Game	Dept. Environ. Cons.	Diamond Alaska Coal Co.	Comments	Sources
A. Physical Environment																		
1. Water																		
Quality			1	2	8	8	1	4						2	3		29	8
Quantity								4									4	1
Surface hydrology		1				1		2	1					3	1		9	6
Groundwater hydrology			1			2		2						2	1		8	5
Marine hydrology						1											1	1
2. Air quality		2	1		1	1	1		8								14	6
B. Biological Environment																		
1. Wetlands						1						3					4	2
2. Freshwater fish			1	1	3	2		1						1			9	6
3. Marine Biology					1	1	2	1				1		1			7	6
4. Wildlife					5	4		4						11			24	4
C. Human Environment																		
1. Employment		2		2	1												5	3
2. Subsistence		1		1	5	2								1			10	5
3. Lifestyle		1		1	7	1											10	4
4. Commercial fishing			1		5	1	1										8	4
5. Increased access		1			1	1	1	2						2			8	6
6. Population increase				1	1			1									3	3
7. Socioeconomics		1	1		1		1										4	4
8. Land use												1					1	1
9. Wilderness		1			1												2	2
D. Project Design and Construction																		
1. Facilities siting						1									1		2	2
2. Mine area																		
Strip mining		1			2												3	2
Overburden stockpile					1	3		1						1	2		8	5
Topsoil storage		2				1											3	2
Coal stockpiles		1				1	1	1									4	4
Coal processing	1	1				1		3									6	4
3. Transportation																		
Corridor location		1			2	1											4	3
Conveyor system	1	2	1		4	1	1	1							1		12	8
Road system			1					2									3	2
4. Port site																		
Trestle	1	2			1			2				2					8	5
Vessel traffic			1		1							1					3	3
5. Housing/airstrip								2									2	1
6. Power generation		1	1		1	2		1							1		7	6

State Agencies

- Department of Natural Resources: The DNR has responsibility for issuing the Surface Mining Permit under authority of the Alaska Surface Coal Mining Control and Reclamation Act. In addition, DNR has responsibility for issuing right-of-way permits across state land, tidelands permits and leases, water rights permits, gravel source permits, permits to construct and modify a dam, and burning permits.

- Department of Fish and Game: The ADF&G has responsibility for issuing Title 16 permits for any actions in anadromous fish streams or which might obstruct fish passage.

- Department of Environmental Conservation: The DEC has responsibility for issuing a Certificate of Reasonable Assurance that states the proposed project would meet state water quality standards. It must also authorize plans, specifications, and proposed methods of operation to assess air quality emission standards and to assure proper disposal of solid wastes. The agency also reviews oil spill contingency plans.

- State Historic Preservation Office: The SHPO has responsibility for issuing a clearance for construction following adequate archaeological surveys.

- Governor's Office of Management and Budget: OMB must concur with the applicant's coastal zone management consistency determination that, to the extent practicable, the project would be consistent with the approved state coastal zone management plan.

Local Government

- Kenai Peninsula Borough: The Borough has local government responsibilities for planning, zoning, and solid waste disposal permitting and, as a landowner, must issue a right-of-way for the transportation corridor across borough lands.

The first formal meeting with the agencies was held on December 11, 1984 in Anchorage. Since then, agency involvement has continued via: 1) formal review of the Responsiveness Summary and issue identification process; 2) field visits to the Diamond Chuitna project site; 3) review of a preliminary draft of the DEIS; 4) a July 25, 1985, meeting to discuss the preliminary draft; and 5) informal phone calls among EPA, EIS team members, and agency personnel.

In addition, the Corps and DNR are formal cooperating agencies for the EIS, as provided for in the Council on Environmental Quality Regulations governing preparation of an EIS. As such, the Corps and DNR throughout the EIS process provided technical assistance in their areas of expertise and in matters relating to permits within their jurisdictions.

7.4 PUBLIC INVOLVEMENT

Public meetings were held January 8-10, 1985 as part of the scoping process. In addition, a meeting was held with environmental groups in Anchorage on December 12, 1984. Oral and written comments from the general public and these groups were documented and addressed in the Responsiveness Summary (Table 7-1).

Environmental groups in Anchorage reviewed a preliminary draft of the DEIS and a meeting with those groups was held on July 26, 1985, to discuss the draft. The Native Village of Tyonek (NVT) and the Tyonek Native Corporation (TNC) reviewed a preliminary draft of the DEIS. A meeting was held with representatives of the two organizations in Anchorage on July 26, 1985.

The public may informally submit questions and requests for information or express concern at any time. In addition, future public participation opportunities will include:

- the formal 60-day period for public review and written comment following publication of this draft EIS.
- public hearings during the draft EIS review period (see dates and locations shown on notice at the beginning of this DEIS) to discuss updated project status, answer questions, and receive comments on the draft EIS. All written comments received during the draft EIS review period will be individually addressed in the EIS.
- a formal review comment period following publication of the final EIS.

7.5 PROJECT INFORMATION CENTERS

Project information and related documents, including the baseline studies, Responsiveness Summary, Table of Contents for the detailed Permit Application to Conduct Surface Mining and the draft EIS, are available for review during normal business hours at the following locations:

Z.J. Loussac Library
524 West 6th Avenue
Anchorage, Alaska

Kenai Community Library
163 Main Street Loop
Kenai, Alaska

Tyonek Village Community Center
Tyonek, Alaska

Sets of the detailed 27-volume Permit Application to Conduct Surface Coal Mining are at the following locations:

Division of Mining
Dept. of Natural Resources
Eighth Floor
3601 C Street (Frontier Bldg)
Anchorage, AK 99503

Diamond Alaska Coal Company
550 W. 7th Avenue, Ste. 1900
Anchorage, AK 99501

Resource Development Dept.
Kenai Peninsula Borough
147 N. Binkley
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8.0 LIST OF PREPARERS

U.S. ENVIRONMENTAL PROTECTION AGENCY

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Diamond Alaska Coal EIS Project Officers

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Jonathan P. Houghton, Ph.D.	Freshwater and Marine Biology
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Stephen R. Braund, M.A. (Stephen R. Braund & Associates)	Subsistence & Socioeconomics
Nancy Hemming (Falls Creek Environmental)	Report Coordinator, Technical Editor

9.0 EIS DISTRIBUTION LIST

9.1 FEDERAL AGENCIES

U.S. Environmental Protection Agency

Office of Federal Activities, Washington, D.C.
Region VIII, Denver, CO
Alaska Operations Office, Anchorage, AK
Air and Energy Research Laboratory, Research Triangle Park, NC

U.S. Department of the Interior

Office of Environmental Project Review, Washington, D.C.
Regional Environmental Officer, Anchorage, AK

U.S. Fish and Wildlife Service
State Director's Office, Anchorage, AK
Alaska Regional Office, Anchorage, AK
Western Alaska Ecological Services, Anchorage, AK

Bureau of Indian Affairs, Juneau, AK

U.S. Geological Survey, Anchorage, AK and Menlo Park, CA

Bureau of Mines, Juneau, AK and Anchorage, AK

National Park Service
Regional Director's Office, Anchorage, AK

Alaska Resources Library, Anchorage, AK

Bureau of Land Management
State Director's Office, Anchorage, AK

U.S. Department of Commerce

National Marine Fisheries Service, Anchorage, AK
Director's Office, Juneau, AK
Office of Surface Mining, Washington, D.C. and Denver, CO
National Oceanic and Atmospheric Administration, Juneau, AK

U.S. Department of Agriculture

U.S. Forest Service, Juneau, AK
  Director's Office
Tongass National Forest, Sitka, AK
Soil Conservation Service, Anchorage, AK
  State Conservationist

U.S. Department of Defense

Department of the Army, Alaska District,
  Corps of Engineers, Anchorage, AK
  District Engineer

U.S. Congress

Honorable Ted Stevens, U.S. Senator
Honorable Frank Murkowski, U.S. Senator

U.S. Department of Health and Human Services

Advisory Council on Historic Preservation,
  Washington, D.C. and Golden, CO
Indian Health Service, Anchorage, AK

9.2 JOINT FEDERAL/STATE

Alaska Land Use Council

Federal Co-Chairman, Anchorage, AK
State Co-Chairman, Anchorage, AK

9.3 STATE AGENCIES

Office of the Governor

Honorable Steve Cowper, Governor
Division of Governmental Coordination, Anchorage, AK

Department of Environmental Conservation

Commissioner's Office, Juneau, AK
Anchorage Western District Office, Anchorage, AK
Division of Environmental Quality Management,
  Juneau, AK

Department of Fish and Game

Office of the Commissioner, Juneau, AK
Habitat Division, Anchorage, AK
Game Division, Soldotna, AK and Anchorage, AK
Sport Fish Division, Anchorage, AK

Department of Natural Resources

Commissioner's Office, Juneau, AK
Div. of Land and Water Management, Anchorage, AK
State Historic Preservation Office, Anchorage, AK
Division of Agriculture, Palmer, AK
Division of Geological and Geophysical Survey, Eagle River, AK
Division of Forestry, Anchorage, AK
Division of Mining, Anchorage, AK
Northcentral District Office, Fairbanks, AK
Coastal Coordinator's Office, Juneau, AK

Department of Transportation and Public Facilities

Commissioner's Office, Juneau, AK

Department of Community and Regional Affairs

Division of Community Planning, Anchorage, AK and Juneau, AK

Department of Commerce and Economic Development

Office of the Commissioner, Juneau, AK
Office of Minerals Development, Fairbanks, AK and Juneau, AK

Department of Labor

Commissioner's Office, Juneau, AK

Department of Law

Office of the Attorney General, Juneau, AK

9.4 LOCAL AGENCIES

Tyonek Native Corporation, Anchorage, AK
City of Seward, Seward, AK
City of Kenai, Kenai, AK
City of Soldotna, Soldotna, AK
Kachemak City, Homer, AK
City of Seldovia, Seldovia, AK
City of Homer, Homer, AK
Kenai Peninsula Borough, Soldotna, AK
Rural CAP, Anchorage, AK
Arctic Slope Regional Corp., Barrow, AK
Native Village of Tyonek, Tyonek, AK
Cook Inlet Region, Inc., Anchorage, AK

9.5 MEDIA

Cheechako News, Kenai, AK
Homer Weekly News, Homer, AK
Seward Phoenix Log, Seward, AK
Peninsula Clarion, Kenai, AK
Anchorage Times, Anchorage, AK
Anchorage Daily News, Anchorage, AK and Kenai, AK

KSRM/KQOK Radio, Soltodna, AK
KRXA Radio, Seward, AK
KGTL/KCNL, Homer, AK
KBBI, Homer, AK
KIMO TV, Anchorage, AK
KTUU Television, Anchorage, AK
KSKA, Anchorage, AK

9.6 INTERESTED GROUPS AND BUSINESSES

AEIDC, University of Alaska, Anchorage, AK
College of Environmental Sciences, U of A, Fairbanks, AK
School of Mineral Engineering, U of A, Fairbanks, AK
University of Wyoming, Laramie, WY
MSHA, Bellevue, WA
CMSHA, Denver, CO
Resource Development Council, Anchorage, AK
Alaska Geological Society, Anchorage, AK
American Institute of Professional Geologists,
  Golden, CO
Western Mining Council, Kenai Chapter, Seward, AK
National Audubon Society, Kenai, AK and Anchorage, AK
Placer U.S. Inc., San Francisco, CA
ERT, Fort Collins, CO
Kenai Community Library, Kenai, AK
Joyce C. Carver Memorial Library, Soldotna, AK
Phillip Smith and Associates, Anchorage, AK
Ralph M. Parsons Co., Pasadena, CA
Air Science, Inc., Lakewood, CO
Cook Inlet Aquaculture Assoc., Soldotna, AK
Trans. AK Engr., Kenai, AK
Boysen and Associates, Soldotna, AK
Yukon Pacific Corp., Anchorage, AK
Coffman Engineers, Anchorage, AK
Exploration Supply & Equipment Inc., Anchorage, AK
Nissho Iwai American Corp. Anchorage, AK
Resource North, Anchorage, AK
Anderson Tug and Barge Co., Seward, AK
Anaconda Minerals Co., Denver, CO
Great Water Associates, Anchorage, AK
U.S. Borax and Chemical Corp., Ketchikan, AK
  and San Francisco, CA
OMD, Fairbanks, AK
Granite Construction Co., Watsonville, CA
GCO Minerals Co., Houston, TX

Ott Water Engineers, Inc., Anchorage, AK
Alaska Miners Association, Anchorage, AK
Institute of Water Resources, U of A, Fairbanks, AK
International Boatel Co., Inc., New York, NY
HARZA-EBASCO, Anchorage, AK
Sierra Club, Juneau, AK and Anchorage, AK
Producer's Liaison, Brookville, PA
Alaska Center for the Environment, Anchorage, AK
Ebasco, Bellevue, WA
Dames & Moore, Seattle, WA
Boatel Alaska Inc., Anchorage, AK
Century Engineering Inc., Anchorage, AK
Div. of Life Sciences, U of A, Fairbanks, AK
RSKERL, Ada, OR
Sierra Club Legal Defense Fund, Juneau, AK
  and Washington, D.C.
Trustees for Alaska, Anchorage, AK
National Wildlife Federation, Washington, D.C.
Billiton Exploration, USA, Inc., Denver, CO
Railfax, Portland, OR
Seattle City Light, Seattle, WA
Getty Mining Co., Salt Lake City, UT
Elmer E. Rasmusson Library, Fairbanks, AK
Environmental Services Ltd., Anchorage, AK
Darbyshire and Associates, Anchorage, AK
Stone & Webster, Denver, CO
Northwest Mining Assoc., Spokane, WA
Harza Engineering Co., Anchorage, AK
Miner's Advocacy Council, Fairbanks, AK
James M. Montgomery Consulting Eng., Inc., Boise, ID
ABAM Engineers, Federal Way, WA
Colorado St. Univ. Libraries, Fort Collins, CO
AMAX Exploration Inc., Golden, CO
Cominco Alaska, Anchorage, AK
Z.J. Loussac Library, Anchorage, AK
Kennecott Corp., Anchorage, AK
Alaska Geological Survey, Fairbanks, AK
R.A. Kreig and Associates, Inc., Anchorage, AK
Alaska Legal Service, Anchorage, AK
Alaska Pacific Bank Corporation, Anchorage, AK
CCC Architects Alaska, Anchorage, AK
Gilbert Commonwealth, Jackson, MI
Natural Resources Defense Council, Washington, D.C.
Chugach Alaska Corp., Anchorage, AK
Harding Lawson Associates, Anchorage, AK
Cable Belt Conveyors, Inc., Miami, FL
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9.7 INTERESTED CITIZENS

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10.0 PUBLIC RESPONSE TO DEIS

(This chapter is reserved for the public and agency comments to be received during the public review period following submittal of the Draft EIS. The comments received will be presented in their entirety in the Final EIS).

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12.0 GLOSSARY OF TECHNICAL TERMS, ACRONYMS, ABBREVIATIONS AND MEASUREMENT EQUIVALENTS

12.1 DEFINITION OF TERMS

Note: The terms defined here have been marked with an asterisk (*) throughout the text.

Term	Definition
Alluvium	Clay, silt, sand, gravel, and similar unconsolidated detrital material deposited recently (in geologic time) by a stream or other body of running water in the bed of the stream or on its flood plain or delta, or as a cone or fan at the base of a mountain slope.
Anadromous	Fish (like salmon) which hatch and often rear for varying periods in freshwater, migrate to the sea for one or more years of accelerated growth, and return to freshwater to spawn.
Andesite	A dark-colored, fine-grained extrusive rock.
Antecedent Moisture Condition	The amount of moisture present in the soil at the beginning of a runoff period.
Anticline	Layered rock strata that have been folded into an arch-shaped structure in which the layers incline away from a central axis. (opposite of syncline).
Base Flow	Sustained or fair-weather flow of a stream.
Batholith	A generally discordant, plutonic mass that has more than 100 square kilometers (40 square miles) in surface exposure and is composed predominately of medium to coarse rocks of granodiorite and quartz monzonite composition.

Term	Definition
Benthic	Pertaining to that which occurs at the bottom of water bodies; especially applies to organisms living on or in bottom sediments.
Borrow	Construction materials such as sand and gravel.
Box Cut	Initial excavation for mine development.
Breccia	Coarse-grained clastic rock composed of large (greater than sand size), angular, and broken rock fragments that are cemented together in a fine-grained matrix.
Cache	Food storage pile.
Confined Ground Water	An aquifer in which the water is under pressure between two impermeable layers of subsurface material such as rock or clay.
Deltaic Deposits	Sedimentary deposits laid down in a delta, characterized by well-developed local cross-bedding and by a mixture of sand, clay, and the remains of brackish water organisms and organic matter.
Detritivore	Animals which feed on decaying material, especially at the bottom of water bodies.
Embayment Deposits	Materials deposited in a deep recess or indentation in a shoreline; generally fine-grained materials such as clay, silt, and sand.
Epibenthic	That which occurs on the surface of sediments at the bottom of water bodies.
Epibiotic	Pertaining to organisms living on the surface of bottom sediments.

Term	Definition
Escapement	The number of anadromous fish which return to freshwater streams and successfully spawn.
Estuarine Deposits	A sedimentary deposit laid down in the brackish water of an estuary, characterized by fine-grained sediments (chiefly clay and silt) of marine and fluvial origin mixed with a high portion of decomposed terrestrial organic matter.
Extrusive Rocks	Rocks that have been ejected onto the surface of the earth; e.g., lava flows, volcanic ash.
Facies	Any observable attribute or attributes (e.g., overall appearance, composition, or conditions of formation) of one part of a rock as contrasted with another or several other parts of the same rock.
Fluvial Deposits	Sedimentary deposits consisting of material transported by, suspended in, or laid down by a river or stream.
Granodiorite	Coarse-grained plutonic rocks containing quartz, plagioclase, and potassium feldspar, with biotite, hornblende, or, more rarely, pyroxene.
Heuristic	Providing aid or direction in the solution of a problem but otherwise unjustified or incapable of justification.
Igneous	Rock which has solidified from molten lava.
Infauna	Community of organisms which live within sediments at the bottom of water bodies.
Interburden	Soil or other material lying between coal seams.

Term	Definition
Intrusive Rocks	Rocks emplaced by the intrusion of lava into pre-existing rocks.
Loess	An unconsolidated, homogeneous blanket deposit of fine-grained materials, predominately composed of silt.
Moraine	A mound, ridge, or other distinct accumulation of unsorted unstratified glacial drift, predominately till, deposited chiefly by direct action of glacial ice.
Natality	Birthrate.
Orographic	Associated with or induced by the presence of mountains.
Overburden	Soil, rock, or other material overlying the upper most coal seam.
Palustrine	Pertaining to materials deposited in marshes.
Periphyton	Organisms, including algae, which live attached to underwater surfaces.
Piezometric Surface	An imaginary surface representing the static head of ground water and defined by the level to which water will rise in a well. A water table is a particular piezometric surface.
Plutonic Rocks	Rocks formed at a considerable depth by crystallization of magma or by chemical alternation; characteristically medium- to coarse-grained and of granitoid texture.
Primary Productivity	Pertaining to organisms such as green plants which have the ability to use light and nutrient energy to manufacture food.

Term	Definition
Pyroclastic Rocks	Rocks that are composed of materials fragmented by volcanic explosion; characterized by a lack of sorting and variability in the size of individual pyroclasts.
Recharge	Absorption and addition of water to the zone of saturation.
Richter Magnitude	The range of numerical values of earthquake magnitude.
Riparian	Located on the bank of a water body.
Riprap	A layer of large, broken rock placed together irregularly to prevent erosion of embankments, causeways, or other surfaces.
Rut	Mating season, especially for big game animals such as moose.
Seismic Risk Zone	One of the zones identified in the Uniform Building Code which is used to determine building construction requirements.
Series	Composed of soils having similar arrangements of horizons and having, within certain limits, similar physical and chemical properties.
Splitter-Hopper	A hopper facility capable of directing coal to more than one destination.
Stamukhas	Sea-ice that has been built up (thickened) by addition of layers of sea-ice being deposited during higher tides over sea-ice layers that have frozen to a tidal flat during earlier lower tides.
Stringer	A very thin, filamentous vein of ore.

Term	Definition
Sub-bituminous	A black coal intermediate in rank between lignite and bituminous coals; higher carbon and lower moisture content than lignite.
Succession	Changes in the plant communities composing an ecosystem as the ecosystem evolves from one type to another, e.g. wetlands becoming grassy meadows.
Sump	A pit which collects water to be pumped at the bottom of the mine.
Syncline	Layered rock strata that have been folded into a trough-shaped structure in which the layers incline towards a central axis; opposite of an anticline.
Unconformity	A substantial break or gap in the geological record where a rock unit is overlain by another unit that is not next in stratigraphic succession.
Volcanic Rocks	Generally finely crystalline or glassy igneous rock resulting from volcanic action at or near the Earth's surface, either ejected explosively or extruded as lava.

12.2 AGENCY ACRONYMS AND ABBREVIATIONS

Federal Agencies

ACHP	Advisory Council on Historic Preservation
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
Corps	Army Corps of Engineers
DA	Department of the Army
DOI	Department of the Interior
EPA	Environmental Protection Agency
FWS	Fish and Wildlife Service
MSHA	Mining Safety and Health Administration
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
NWS	National Weather Service
USGS	United States Geological Survey

State of Alaska Agencies

ADF&G	Alaska Department of Fish and Game
AEIDC	University of Alaska, Arctic Environmental Information & Data Center
DEC	Department of Environmental Conservation
DGGS	Division of Geological and Geophysical Survey
DNR	Department of Natural Resources
DOT/PF	Department of Transportation & Public Facilities
SHPO	State Historic Preservation Office

Other

ANCSA	Alaska Native Claims Settlement Act of 1971
ANILCA	Alaska National Interest Lands Conservation Act of 1980
BACT	Best Available Control Technology
CINA	Cook Inlet Native Association
CIRI	Cook Inlet Region, Inc.
KLM	Kodiak Lumber Mill
KPB	Kenai Peninsula Borough
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NVT	Native Village of Tyonek
ORV	Off-road Vehicles
PSD	Prevention of Significant Deterioration
ROD	Record of Decision
SPCC	Spill Prevention, Control and Countermeasure Plan
TNC	Tyonek Native Corporation
VQO	Visual Quality Objective
VRM	Visual Resources Management

12.3 METRIC/ENGLISH MEASUREMENT, ABBREVIATIONS AND EQUIVALENTS

Metric Unit (Abbrev.)	Equivalent		English Unit (Abbrev).
centimeter (cm)	2.54 cm	= 1 in	inch (in)
meter (m)	0.3048 m	= 1 ft	foot (ft)
kilometer (km)	1.6093 km	= 1 mi	mile (mi)
hectare (ha)	0.4047 ha	= 1 ac	acre (ac)
square kilometer (km^2)	2.590 km^2	= 1 mi^2	square mile (mi^2)
liter (l)	3.78541	= 1 gal	gallon (gal)
cubic meter (m^3)	0.0283 m^3	= 1 ft^3	cubic feet (ft^3)
cubic meter (m^3)	0.7646 m^3	= 1 yd^3	cubic yard (yd^3)

Metric Unit (Abbrev.)	Equivalent		English Unit (Abbrev).
cubic dekameter (dam^3)	1.2335 dam^3	= 1 ac-ft	acre-foot (ac-ft)
cubic meter per second (m^3/s)	0.0283 m^3/s	= 1 ft^3/s	cubic feet per second (ft^3/s)
kilogram (kg)	0.4536 kg	= 1 lb	pound (lb)
metric ton (Mt)	0.9072 Mg	= 1 ton	short ton (2,000 lb)
meter per second (m/s)	0.5144 m/s	= 1 knots	knot (knot)
meter per second (m/s)	0.3048 m/s	= 1 ft/s	feet per second (ft/s)
miligram per liter (mg/l)	1.0 mg/l	= 1 ppm	part per million (ppm)
degrees Celsius (°C)	(1.8x°C)+ 32	= °F	degrees Fahrenheit (°F)
barrels (bbls)			barrels (bbls)

12.4 OTHER MEASUREMENTS AND ABBREVIATIONS

Before Present (B.P.)
decibel level A (dbA)
dead weight ton (dwt)
megawatt (MW)
Kilovolt (KV)
parts per billion (ppb)
parts per million (ppm)
gallons per day (gpd)
milliequivalents per liter (meq/l)
nannometric turbidity unit (NTU)

13.0 INDEX

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APPENDIX A
TERRESTRIAL HABITAT EVALUATION

1.0 INTRODUCTION

This terrestrial habitat analysis was done for the Diamond Chuitna Coal Project EIS using data collected from several sources including the coal project baseline studies, the Susitna River Basin studies conducted by the Alaska Department of Fish and Game (ADF&G), the U.S. Fish and Wildlife Service (USFWS) and other government agencies, and the USFWS Habitat Evaluation Program. The purpose of the analysis was to identify the types and quantities of habitats which would be affected by the coal project, to describe their values to key wildlife species, and to provide a quantitative basis for comparison of habitat impacts among project alternatives and between premining and postreclamation conditions.

2.0 METHODS

Evaluation species were selected on the basis of their high public interest and/or because they serve as indicator species for habitats that have significant ecological value. Using these criteria, the following species were chosen: moose (Alces alces), brown bear (Ursus arctos), black bear (U. americanus), trumpeter swan (Cygnus buccinator), and lesser sandhill crane (Grus canadensis). Moose, brown bear, and black bear are upland species whereas swans and sandhill cranes inhabit wetland and aquatic habitats.

The basis for the terrestrial habitat evaluation was the composite vegetation maps developed by the Soil Conservation Services (SCS) and USFWS for the Beluga region and the vegetation maps developed during the project baseline study program (ERT 1984b). The ERT maps are at a larger scale than those produced by SCS/USFWS and were used for habitat delineation within the mine area, southern transportation corridor, and Granite Point port area. Direct comparisons between the two mapping efforts were difficult due to the significant differences in vegetation interpretation. The differences are outlined in Table 1.

The habitat units used in the analyses for each species roughly correspond to the vegetation units delineated on the base maps. The units were then grouped into four categories which correspond with the habitat value ratings from the USFWS mitigation policy (Table 2). The ratings indicate the extent to which a particular habitat provides the life requirements for the species under consideration. It is a rating of a habitat's overall suitability. A habitat for a particular species is considered only as valuable as the life factor which is the most limited.

Table 1

VEGETATION CLASSIFICATION SYSTEM CORRELATION

Map Unit #	Vierreck et al. (1982)	Map Unit #	U.S. Forest Service (1979)	U.S. Fish and Wildlife Service (1979)
1	Closed Broadleaf Forest/Paper Birch	24	Closed broadleaf forest/paper birch	--
2	Open Broadleaf Forest/Balsam Poplar	28	Cottonwood, medium aged stands[1]	
-	Closed Needleleaf Forest/White Spruce[2]	25	Coniferous, white spruce, tall stands, closed forest[1]	Palustrine - forested needleleaved evergreen
3	Open Mixed Forest/Spruce-Birch	26	Deciduous, mixed, old stands, closed forest	Palustrine - forested mixed needleleaved evergreen, broadleaved deciduous[3]
4	Needleleaf Woodland/Black Spruce	41	Black spruce, short stands, closed forest	Palustrine - forested needleleaved evergreen[4]
5	Mixed Woodland/Spruce-Birch	32	Deciduous, mixed, medium aged, woodland	Palustrine - forested mixed needleleaved evergreen broadleaved decidous[3]
5	Mixed Woodland/Spruce-Birch	34	Deciduous, mixed, old stands, woodland	Palustrine - forested needleleaved evergreen broadleaved deciduous[3]
6	Open Tall Shrub Scrub/Willow	61	Alder-willow	Palustrine - scrub/shrub broadleaved deciduous[4]
7	Closed Tall Shrub Scrub/Alder	60	Alder	Palustrine - scrub/shrub broadleaved deciduous[3]
8	Open Low Shrub Scrub/Sweetgale-Grass Fen	68	Sphagnum bog	Palustrine - emergent narrowleaved persistent[4]
8	Open Low Shrub Scrub/Sweetgale-Grass Fen	69	Sphagnum shrub bog	Palustrine - scrub/shrub broadleaved deciduous[4]
-	Open Low Scrub/Willow-Grass Tundra[2]	64	Sedge-grass	Palustrine - emergent persistent[3]
-	Dry Gaminoid Herbaceous/Midgrass-Shrub[2]	65	Herbaceous	Palustrine - emergent persistent[4]
9	Mesic Gaminoid Herbaceous/Bluejoint-Herb	63	Upland grass	Palustrine - emergent persistent[4]

[1] Not mapped within Diamond-Chuitna study area.
[2] Not identified within lease area or transportation corridor.
[3] Classified as wetland when located on floodplains.
[4] Classified as wetland when located on very poorly and poorly drained soils or on floodplains.

Table 2

RESOURCE CATEGORIES AND MITIGATION PLANNING GOALS[1]

Resource Category	Habitat Value	Designation Criteria	Mitigation Planning Goal
1	very high	Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.	No loss of existing habitat value.
2	high	Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section.	No net loss of in-kind habitat value.
3	medium	Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis.	No net loss of habitat value while minimizing loss of in-kind habitat value.
4	low	Habitat to be impacted is of medium to low value for evaluation species.	Minimize loss of habitat value.

---

[1] Taken from FWS Mitigation Policy (FR Vol. 46, No. 15, 23 January 1981).

Models of species-specific habitat requirements have been constructed by USFWS for many Alaskan wildlife species using all pertinent data available (USFWS 1980). These models and the model of moose habitat developed by ADF&G for the Susitna River Basin were used in this study.

The habitat parameters used in the models are discussed below in the species accounts. In addition, snow accumulation was included as a parameter for this analysis as it was considered a habitat factor of major importance for several of the species under consideration. From snow accumulation contours developed for the Susitna River Basin study, an estimate of 152 m (500 ft) was chosen as the elevation above which moose would encounter mobility problems in the winter due to snow depth (ADF&G 1984). It also was considered the level above which the ice-free season was too short to allow trumpeter swan nesting (King 1968; Hansen et al. 1971).

To provide additional perspective to the question of moose winter habitat value, the distribution of moose based on actual field observations (Faro 1985a) was delineated on the winter range maps. A fall rutting concentration, not directly related to vegetation type, was also delineated based on field observations (Faro 1985a).

Location maps of proposed project components were overlain on the vegetation maps and the surface area of the habitat types within their boundaries was estimated using a compensating polar planimeter. Areas were rounded to the nearest acre and then converted to hectares. The area of affected habitat along the southern transportation corridor was con-sidered to be the area from the west side of the haul road to the east side of the conveyor system except where the road separates from the conveyor at the Chuitna River crossing. The 61 m (200 ft) undisturbed buffer zone between the haul road and conveyor was considered part of the direct habitat loss for this analysis.

3.0 SPECIES ACCOUNTS

3.1 LESSER SANDHILL CRANE

3.1.1 Life History Information

Sandhill cranes are common summer residents and breeders in the Cook Inlet Region. They are most abundant during spring and fall migration and use tidal flats and muskegs of the area for staging and feeding. They are common nesters in the refuges of upper Cook Inlet but were found to be uncommon nesters in the Beluga region (ERT 1984a).

Sandhill cranes are birds of open country. Their summer habitat consists of tundra areas with short vegetation such as mosses, labrador tea (Ledum spp.) dwarf birch (Betula spp.) crowberry (Empetrum nigrum), and cloudberry (Rubus chanaemorus) (Walkinshaw 1949). Cranes roost at night and during the day between periods of feeding in wetlands and aquatic areas. They are opportunistic omnivores and are able to subsist on a wide variety of food items such as crowberry, cloudberry, mice, small fish, snails, and flying insects (Boise 1977). Breeding cranes usually feed within close proximity of the nest (Walkinshaw 1949).

3.1.2 Habitat Parameters

Most habitat work related to sandhill cranes in Alaska has been done in the tundra habitats of the Yukon-Kuskokwim Delta. These studies, which primarily addressed suitability of habitats for feeding and nesting, indicate that dry sites near water bodies appear to be very important for nesting. Cranes also prefer sites which offer unobstructed views of the surrounding terrain. Habitat parameters for lesser sandhill cranes are outlined on Table 3.

Because data from other geographic regions were lacking, no attempt was made to rate habitat values according to the Table 2 criteria; rather, a simple model was developed to differentiate between suitable and unsuitable crane habitat for the Diamond Chuitna project. Cover and suitability for reproduction were the life requirements used to delineate overall habitat suitability. Habitat above 152 m (500 ft), which might otherwise be considered suitable, was determined to be limiting for reproduction due to late snow melt off.

3.2 TRUMPETER SWAN

3.2.1 Life History Information

Trumpeter swans are common migrants and breeders on the Kenai Peninsula and along the west coast of Cook Inlet (USFWS 1980). Once thought to be endangered, recent surveys of trumpeters on their breeding grounds indicate an expanding population with a 94 percent increase between 1975 and 1980. A high ratio of non-breeding to breeding swans in Alaska appears indicative of the fact that the swans are near the northern limit of their range.

Breeding trumpeters require relatively shallow static ponds or lakes which range in size from 2.4 to 14 ha (6 to 35 ac) with significant amounts of emergent vegetation such as Equisetum fluviatile, Carex sp. and Menyanthes trifolia (Hansen et al. 1971). A 145- to 150-day span between breakup and freezeup is needed to successfully complete the reproductive cycle (Hansen et al. 1971). This suggests that, in the project area, most breeding takes place below 500 feet elevation (King 1968; Hansen et al. 1971).

Table 3

HABITAT PARAMETERS FOR EVALUATION OF SANDHILL CRANE HABITAT SUITABILITY

Life Requisite	Habitat Suitability Suitable	 Unsuitable
Cover	open habitat low vegetation good visibility of surrounding area	closed to open forest tall shrub poor visibility of surrounding area
Reproduction	wet with occasional raised areas 73 m (80 yd) or less to freshwater body below 152 m (500 ft) elevation	uniformly wet with no raised areas uniformly dry greater than 73 m (80 yd) to freshwater body greater than 152 m (500 ft) elevation

Source: USFWS 1980

The range of non-breeding swans is closely tied to that of the breeding population. Ponds and lakes used by non-breeders should provide adequate open water and emergent vegetation should not be used by breeding pairs because territorial conflicts may arise (USFWS 1980). Since the present population is expanding, lakes and ponds which appear suitable for breeding but are not used at this time must be considered potential breeding habitat.

3.2.2 Habitat Parameters

The available baseline data on potential habitats for swans in the study area are somewhat limited since the vegetation map units are quite broad and do not address aquatic vegetation or water depth along the shores of lakes and ponds. Adult and juvenile swans feed on land only to a limited extent; cygnets feed exclusively in the water. Therefore, upland terrestrial vegetation along the perimeters of water bodies was not considered in the analysis. Habitat parameters for trumpeter swans are presented in Table 4. The 152 m (500 ft) contour was used as an approximate upper limit for breeding habitat. The extent of aquatic and emergent vegetation was determined from wetland maps developed by the USFWS wetlands inventory.

Table 4

HABITAT PARAMETERS FOR EVALUATION OF TRUMPETER SWAN HABITAT SUITABILITY

Life Requisite	Habitat Suitability High	 Medium	 Low
Size of pond or lake	2.4 - 14 ha (6 - 35 ac)	14.4 - 51.2 (36 - 128 ac)	>51.2 ha (128 ac)
Reproduction Elevation above sea level	<152 m (500 ft)	<152 m (500 ft)	>152 m (500 ft)
Food and cover Aquatic and emergent vegetation	Abundant	Common	Uncommon to none

Source: USFWS 1980

3.3 BLACK BEAR

3.3.1 Life History Information

Black bears are common residents of the Cook Inlet region and are found in many different habitat types. They feed primarily on grasses, sedges (*Carex* sp.), horsetail (*Equisetum* sp.), and when available, carrion (ADF&G 1976). Late summer and fall food items consist primarily of salmon and berry-producing plant species such as blueberry (*Vaccinium* sp.), elderberry (*Sambucus rasemosa*), bearberry (*Arctostapholos* sp.), crowberry (*Empetrum nigrum*), and high-bush cranberry (*Viburnum edule*). Bears of all ages avoid extensive open areas such as grasslands, low shrublands, and tundra except when they are feeding on alpine berry patches or in tideflats (Schwartz and Franzman 1980; Fame 1974; McIlroy 1970). Black bears usually do not range further than 315 m (350 yd) from cover to feed (Pacific Working Group 1977). Females with cubs will often remain near mature trees so that escape cover is readily available for the cub.

3.3.2 Habitat Parameters

The primary habitat characteristics used to evaluate black bear habitat in the project area were the availability and diversity of preferred herbaceous food species, availability of salmon, and the proximity to mature trees. These parameters are shown on Table 5.

Table 5

HABITAT PARAMETERS FOR EVALUATION OF BLACK BEAR HABITAT SUITABILITY

Life Requisite	Habitat Suitability		
	High	Medium	Low
Food			
Diversity of food species	2-4 species	1 species	-
% cover herbaceous food species spring/early summer	16 - 100%	5 - 15%	< 5%
Availability of salmon	common to abundant	uncommon	rare to none
Cover			
Proximity to mature trees (Escape cover)	<400 m (440 yd) to mature trees or tall shrub with >25% canopy cover	400 m (440 yd) to 8 km (5 mi)	>5 mile to mature trees

Source: USFWS unpublished model

3.4 BROWN BEAR

3.4.1 Life History Information

Brown bears are distributed throughout much of the coastal area of Cook Inlet including the Beluga region. They are generally solitary animals. Brown bears feed on sedges, grasses (Calamagrostis sp. and Arctogrostis sp.), and horsetails during the spring and early summer but will use a wide variety of foods when available (Sommerville 1965). During the summer and fall, bears feed on salmon. From mid-summer through fall, bears also rely heavily on several types of berries including blueberries, soapberries (Shiphardia canadensis), crowberries, bearberries, and lowbush cranberries (Vaccinium vitisideae) (USFWS 1980).

Brown bears are found in a variety of habitat types but generally prefer relatively open higher areas (Erickson 1965; Sommerville 1965). They also extensively utilize low-lying areas free of snow in the spring after emerging from their dens. Bears on Kodiak Island spent 50 percent of their time in low-lying areas, 35 percent in foothills, and 15 percent in uplands (Berns and Hensel 1972).

Elevation of denning habitats varies in Alaska. In the upper Susitna Valley, dens were found at elevations averaging 1,468 m (4,818 ft) (Miller and McAllister 1982). On Kodiak Island and the Alaska Peninsula, dens averaged 549 m (1,800 ft) and 396 m (1,300 ft) in elevation, respectively. Bears within the study area very likely den at lower elevations (ERT 1984a). DOWL (1981) suggests that much of the Beluga area is unusable or marginal bear denning habitat because it is an elevated plateau and has considerable lowland tree cover.

3.4.2 Habitat Parameters

The parameters used to evaluate brown bear habitats in the project area were food value (by season) and cover (Table 6). Reproduction was not used as an evaluation parameter. Brown bears have relatively large home ranges. It is quite possible that if vegetation types within the project area were not optimum for food, bears would feed in adjacent more suitable areas.

3.5 MOOSE

3.5.1 Life History Information

Moose are common inhabitants of the Beluga region and constitute an important economic resource for residents and non-residents alike. Moose are primarily associated with habitat types that include lowland bog communities, upland shrub areas, and early successional communities influenced by fire or flooding (LeResche et al. 1974).

Calving occurs from late May through June and takes place primarily in lowland bog areas. Cows with calves often remain in these areas throughout the summer so that they can feed on the abundant herbaceous vegetation found there. Moose move from their lowland wintering areas into upland shrub areas throughout the summer and fall. In late fall and early winter, they move down into willow communities along rivers and streams (LeResche et al. 1974).

Moose feed mostly on browse-type vegetation. Of these, willows (*Salix* sp.) are the most important species followed by birch (*Betula* sp.). Other species consumed are cottonwood (*Populus* sp.), aspen (*Populus tremuloides*), and alder (*Alnus* sp.). During the winter, 80 percent of the diet consists of browse species, whereas during the summer, grasses and forbs constitute a significant portion of the diet. Important species include sedges, horsetail, bluejoint grass (*Calamagrostis canadensis*), and fireweed (*Epilobium angustifolium*) (USFWS 1980).

Table 6

HABITAT PARAMETERS FOR EVALUATION OF BROWN BEAR HABITAT SUITABILITY

Life Requisite	Habitat Suitability High	Medium	Low
Food			
% grasses and horsetail (spring/early summer)	>20%	10-20%	<10%
% berry-producing species (late summer/early fall)	>20%	1-19%	-
Distance to salmon stream (late summer/early fall)	<30 mi	30-50 mi	>50 mi
Cover			
% tree canopy cover	0-60%	60-100%	-

Source: USFWS 1980

3.5.2 Habitat Parameters

Because habitat requirements for moose differ seasonally, the criteria used for the analysis were divided into two categories: winter range and spring/summer/fall range. Parameters used were food value and cover. Key variables for both seasons were browse quality (i.e., vegetation species and percent of total available browse), quantity (total available willow, birch, and alder), and presence of lowbush cranberry (Tables 7 and 8).

4.0 HABITAT ANALYSIS RESULTS

Up to 2,500 ha (6,175 ac) would be lost as a result of the development of the mine and mine facilities, transportation corridor, airport, housing facilities, and port site. The area includes seven of the nine vegetation types located within the project area and approximately 40 ha (99 ac) of aquatic habitat in the form of small ponds. The vegetation type sustaining the greatest loss would be mixed woodland/spruce-birch followed by closed tall shrub scrub/alder and low shrub/sweetgale-grass fen, respectively. The latter is a wetland vegetation type.

The habitat suitabilities of the vegetation types according to the parameters examined for the key wildlife species are summarized in Table 9. Table 10 provides a

Table 7

HABITAT PARAMETERS FOR EVALUATION OF MOOSE WINTER RANGE SUITABILITY

Life Requisite	Habitat Suitability High	 Medium	 Low
Food			
Browse quality species and % total available	*Salix* sp. *Betula paperifera* *Populus* sp.	*Salix* sp. *Betula glandula* *Betula nana*	*Alnus* sp.
Browse quantity total available *Salix* sp., *Betula* sp., *Alnus* sp.	>300 lb/ac	100-200 lb/ac	1-99 lb/ac
% cover of *Vaccinium vitis-idaea*	>5%	1-5%	<1%
Cover[1]			
Availability of cover as indicated by canopy[2] closure	CL-CF CL-DF CL-MF	OP-CF OP-DF OP-MF	T/S

---

[1] Cover types - CF - Coniferous forest
DF - Deciduous forest
MF - Mixed forest
LS - Low shrub
TS - Tall shrub
HSG - Herbaceous sedge/grass

[2] Canopy type - CL - Closed
OP - Open

Source: ADF&G 1984

Table 8

HABITAT PARAMETERS FOR EVALUATION OF MOOSE SPRING/SUMMER/FALL RANGE SUITABILITY

Life Requisite	Habitat Suitability		
	High	Medium	Low
Food			
Browse quality species and % total available	*Salix* sp. *Betula paperifera* *Populus* sp.	*Salix* sp. *Betula glandulosa* *Betula nana*	*Alnus* sp.
Browse quantity total available *Salix* sp., *Betula* sp., *Alnus* sp.	>300 lbs/ac	100-299 lbs/ac	1-99 lbs/ac
Total annual forb production	>120 lbs/ac	300-120 lbs/ac	0-30 lbs/ac
Cover			
Availability of cover as indicated by canopy[2] closure	CL-CF CL-DF CL-MF OP-CF OP-DF OP-MF	-	TG LS HSG

---

[1] Cover types - CF - Coniferous forest
DF - Deciduous forest
MF - Mixed forest
LS - Low shrub
TS - Tall shrub
HSG - Herbaceous sedge/grass

[2] Canopy type - CL - Closed
OP - Open

Source: ADF&G 1984

Table 9

HABITAT SUITABILITY OF VEGETATION MAP UNITS FOR WILDLIFE SPECIES

	High		Medium		Low	
Species/ Mapping System	SCS[1]	Viereck[2] et al. 1982		Viereck et al. 1982	SCS	Viereck et al. 1982
Sandhill crane	68,69	8	-	-	-	-
Trumpeter swan	68,69 92	8	91	-		
Black bear	24,26,28 41,32,34 60,61,63 68,69	1,2,3,4 5,7,8,9				
Brown bear	25,26,28 32,34,41 60,61,63 64,65,68 69	2,3,4 5,6,7 8,9	22,24	1		
Moose (spring/ summer/ fall)	24,32,61	1,5,6	21,22,25 26,27,28 29,31,33 34,35,36 60,62,63 68,69	2,3,7 8,9	41,42,43 46	4
Moose (winter)	24,25,27 31,32,61	1,5,6	21,22,26 28,29,33 34,36,41 42,60,62	2,3,4 7	35,43,46 51,63,68 69	8,9

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[1] Vegetation classification scheme used in mapping areas outside the project area developed by the USDA, Soil Conservation Service (SCS).

[2] Vegetation classification scheme used within the project area developed by Viereck et al. (1982).

Table 10a

DIRECT LOSS OF WILDLIFE HABITAT AND SUITABILITY OF HABITATS IN HECTARES (ACRES) FROM MINE DEVELOPMENT BY PROJECT COMPONENT

			10 Year Mine Limit			30 Year Mine Limit
Species		Mine Service Area	Pit Area	Stockpile Areas	Roads and Settling Ponds	Pit Area
Sandhill Crane	Suitable	0	0	0	0	0
	X	---	0	0	---	0
	X	---	0	0	---	0
	Unsuitable	22(55)	564(1411)	80(200)	68(169)	2029(5012)
Trumpeter Swan	High	0	0	---	---	0
	Med	0	0	---	---	0
	Low	0	0	---	---	0
	NU[2]	22(55)	575(1438)	80(200)	68(169)	2029(5012)
Black Bear	High	22(55)	564(1411)	80(200)	64(158)	1982(4955)
	Med	0	0	0	0	0
	Low	0	0	0	0	0
	NU	0	11(27)	0	4(10)	23(57)
Brown Bear	High	22(55)	564(1411)	79(198)	64(158)	1982(4955)
	Med	0	0	0	---	0
	Low	0	0	0	---	0
	NU	0	11(27)	1(2ac)	4(10)	23(57)
Moose Spring/Summer/ Fall	High	14(35)	380(950)	47(117)	47(117)	1356(3349)
	Med	8(20)	85(212)	33(83)	21(52)	653(1612)
	Low	0	180(449)	0	0	20(49)
	NU	0	0	0	0	0
Moose Winter	High	0	0	0	0	0
	Med	0	0	0	0	0
	Low	0	0	0	0	0
	NU	22(55)	575(1438)	80(200)	68(169)	2029(5012)
Total		22(55)	575(1438)	80(200)	68(169)	2029(5012)

[1] Exact sighting not finalized.

[2] Not utilized.

Table 10b

DIRECT LOSS OF WILDLIFE HABITAT AND SUITABILITY OF HABITATS IN HECTARES (ACRES) FROM MINE DEVELOPMENT BY PROJECT COMPONENT

		Port Sites		Transportation Corridors			Housing Facilities and Airport			Material Sites[1]		
Species		Granite Point	Ladd	Southern	Eastern	Northern	Lone Creek	Three-Mile	Congahbuna Lake[1]	#5	#7	#8
Sandhill Crane	Suitable	64(158)	6(16)	16(40)	14(35)	23(56)	0	0	6(15)	0	0	15(37)
	X	0	0	0	0	0	0	0	0	0	0	0
	X	0	0	0	0	0	0	0	0	0	0	0
	Unsuitable	16(41)	113(277)	53(131)	40(99)	50(124)	29(72)	29(72)	23(57)	106(262)	119(294)	119(294)
Trumpeter Swan	High	0	9(23)	0	2(6)	1(3)	0	0	2(5)	0	0	0
	Medium	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU[2]	80(198)	110(271)	69(171)	52(128)	72(177)	29(72)	29(72)	27(67)	106(262)	119(294)	134(331)
Black Bear	High	80(198)	116(287)	69(171)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)
	Medium	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
Brown Bear	High	80(198)	116(287)	67(166)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)
	Medium	0	0	2(5)	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
Moose Spring/Summer/ Fall	High	0	0	22(54)	4(10)	5(12)	25(62)	0	10(25)	85(210)	119(294)	91(224)
	Medium	74(183)	116(287)	46(114)	50(124)	68(168)	4(10)	29(72)	19(47)	21(52)	0	45(111)
	Low	6(15)	0	1(3)	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
Moose Winter	High	0	0	1(2)	0.5(2)	2(4)	0	0	10(25)	0	119(294)	0
	Medium	16(41)	110(271)	3(8)	29(73)	32(79)	0	29(72)	2(5)	0	0	0
	Low	64(157)	6(16)	38(93)	14(34)	22(53)	0	0	3(6)	0	0	0
	NU	0	3(7)	28(68)	19(47)	18(45)	29(72)	0	14(36)	106(262)	0	134(331)
Total		80(198)	119(293)	69(171)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)

[1] Exact sighting not finalized.

[2] Not utilized.

breakdown by project component of the surface area of the various habitat types according to the value to the key species.

4.1 LESSER SANDHILL CRANE

Distribution of sandhill crane habitat for the study area is given on Figure 1 and within Diamond Alaska's proposed project area on Figure 2.

The only vegetation type found to be suitable for sandhill cranes was open low shrub/sweetgale-grass fen. These wetland areas provide adequate open space, food species, and patterned ground necessary for nesting. Areas below the 152 m (500 ft) contour were classified as having an overall habitat quality suitable for nesting cranes. Significantly better crane habitat is found just southwest of the study area in the lowlands of Trading Bay Refuge.

4.1.1 Port Areas

A significant portion (80 percent) of the area of proposed development at the Granite Point Port site is classified as having some suitability for cranes. Only a relatively small portion (2 percent) of the proposed development at the Ladd port site is classified as having some suitability for cranes.

4.1.2 Transportation Corridors

A total of 16 ha (40 ac) of suitable crane habitat makes up only 23 percent which will be lost to the development of the haul road and conveyor system in the southern corridor. Approximately the same amount (27 percent total) of crane habitat would be affected by the eastern corridor. The largest amount of crane habitat 23 ha (56ac) or 32 percent, would be lost within the northern corridor.

4.1.3 Mine and Mine Facilities

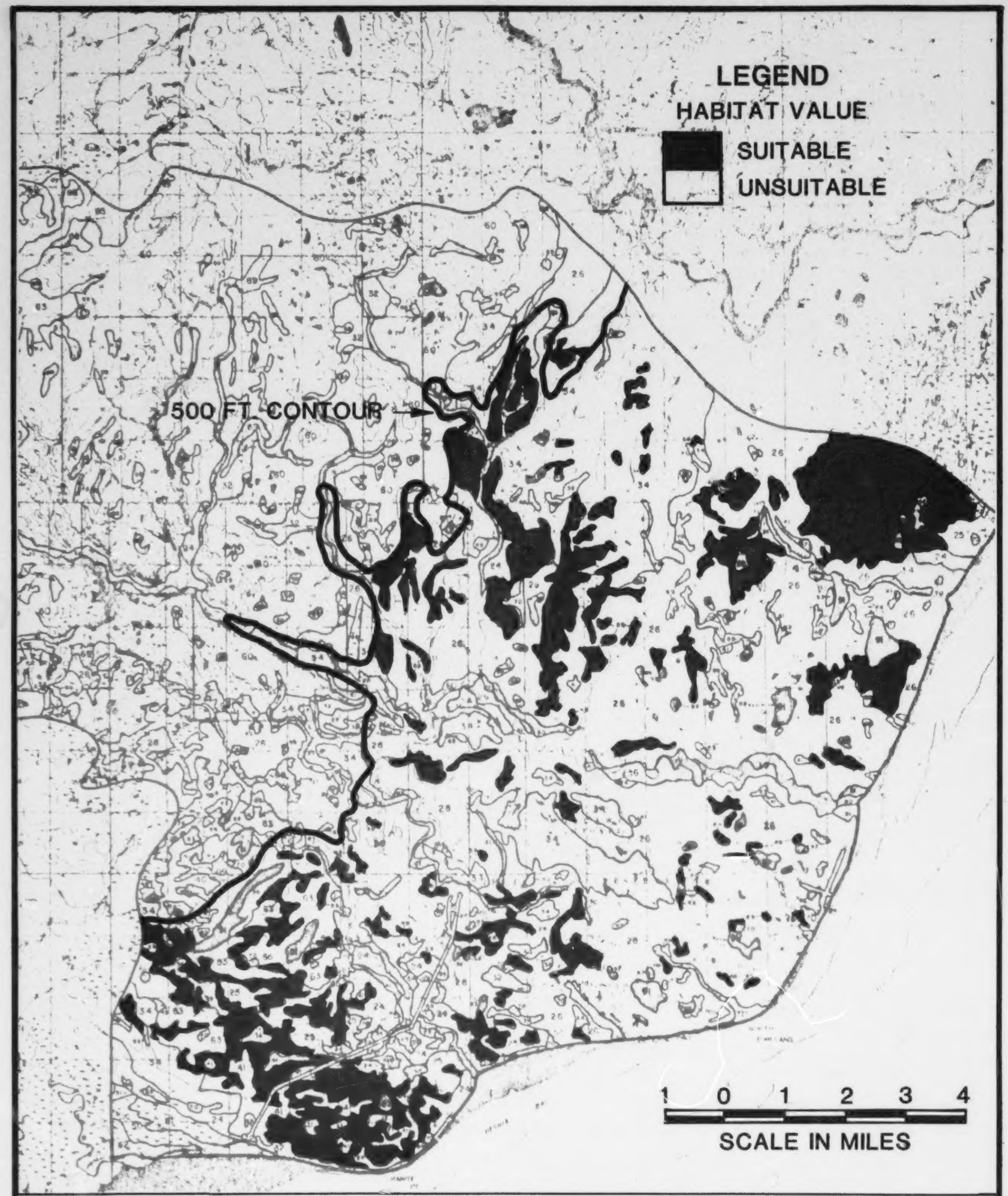
The low shrub communities in the mine area were considered of limited value for reproduction due to shortness of the ice-free season. These areas could possibly provide some feeding or roosting habitat for sandhill cranes.

4.1.4 Airport and Housing Facilities

Only small areas of suitable open low shrub habitat would be lost to development at the Lone Creek site. Use by nesting cranes would be limited by elevation.

The Threemile housing facility site has no suitable crane habitat within the area to be cleared.

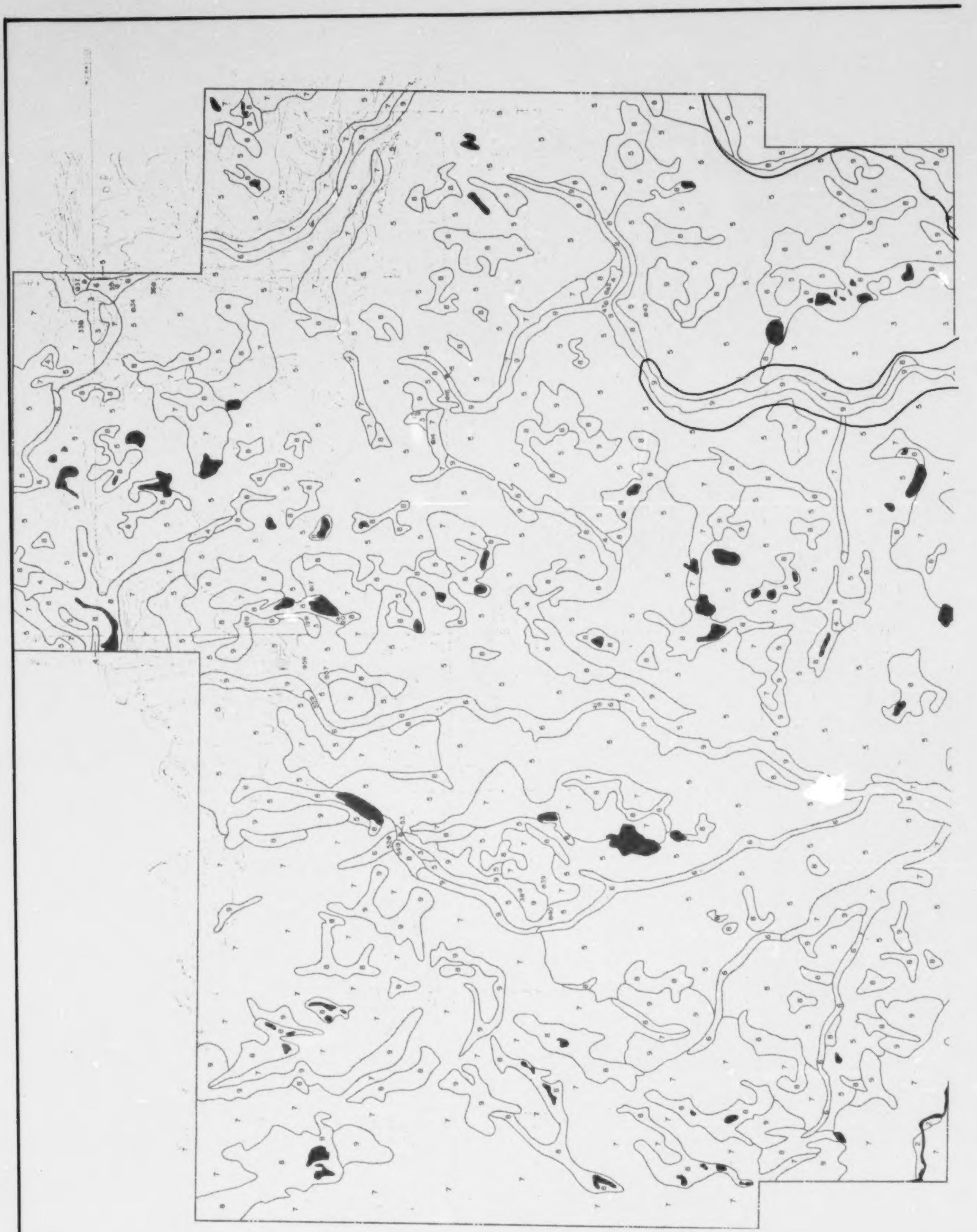
The Congahbuna Lake site is near the 152 m (500 ft) contour, but would likely receive some crane use. Approxi-


LEGEND
HABITAT VALUE
SUITABLE
UNSUITABLE
500 FT. CONTOUR
1 0 1 2 3 4
SCALE IN MILES

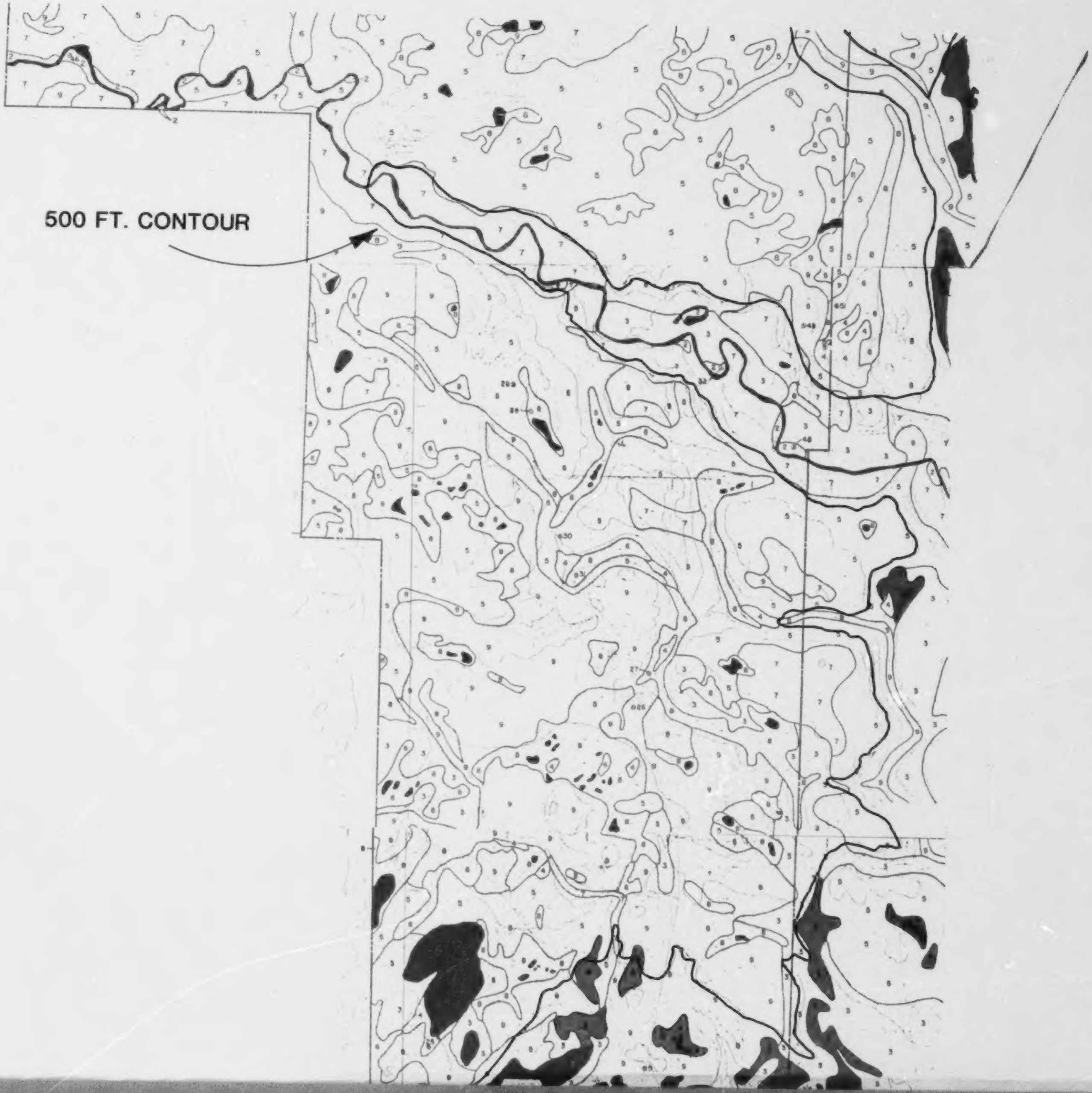
SANDHILL CRANE NESTING HABITAT IN STUDY AREA

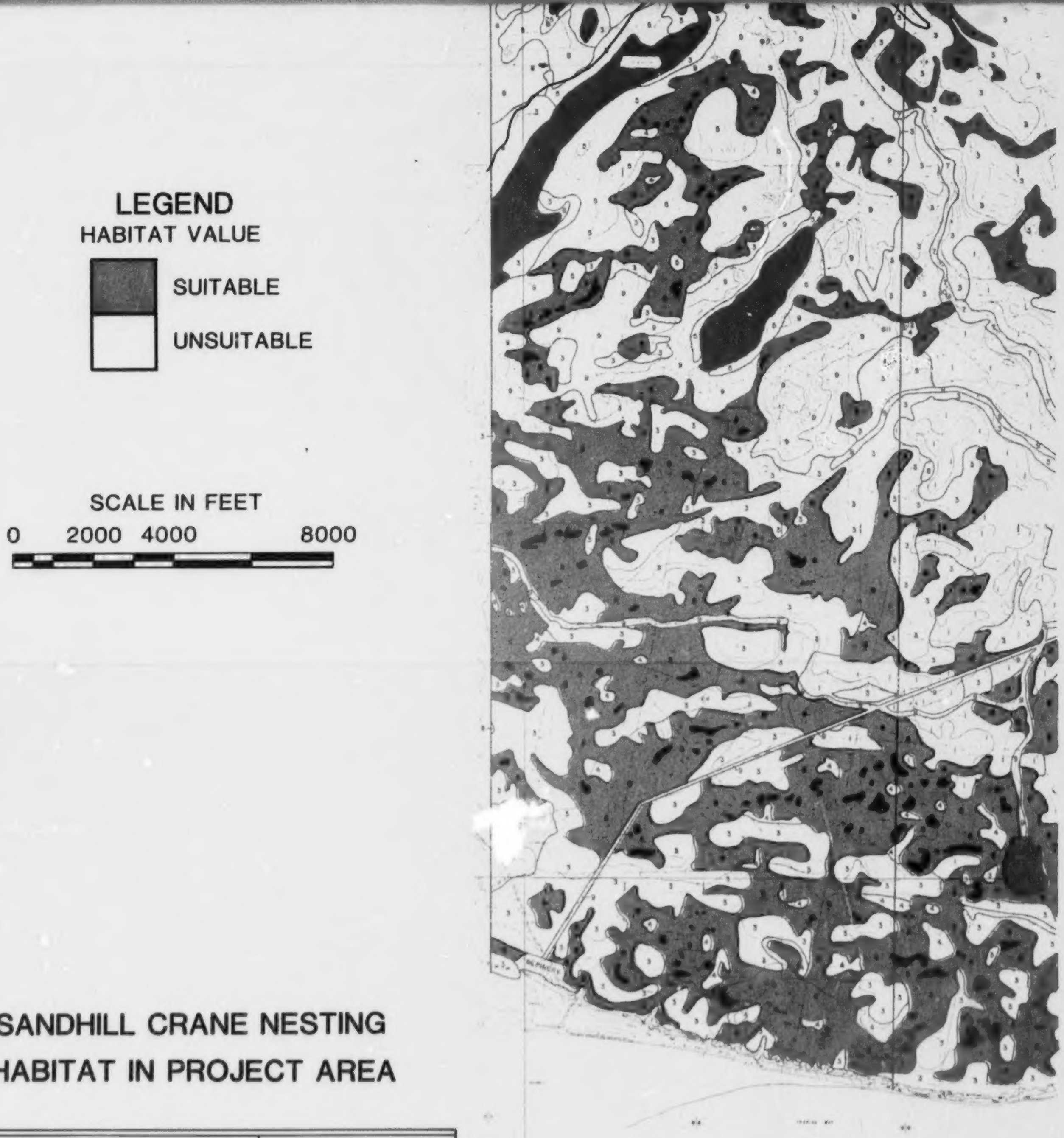
Diamond Chuitna Environmental Impact Statement

FIGURE 1



A-18a


500 FT. CONTOUR


LEGEND
HABITAT VALUE
SUITABLE
UNSUITABLE
SCALE IN FEET
0
2000
4000
8000

SANDHILL CRANE NESTING HABITAT IN PROJECT AREA

Diamond Chuitna Environmental Impact Statement	FIGURE 2

mately 20 percent would be suitable crane habitat. Since the exact site has not been delineated, this amount may vary.

4.1.5 Material Sites

The only material site with any significant amount of potential crane habitat is Site #8 which has approximately 15 ha (37 ac) of low shrub habitat. This area is proximate to the 152 m (500 ft) elevation which suggests it has limited value for crane reproduction.

4.2 TRUMPETER SWAN

Within the study area, a total of 14 suitable aquatic habitats were identified as having potentially high value as swan nesting habitat. Only areas of potentially high value were delineated outside the Diamond Alaska project area (Figure 3). Habitat possibly suitable for swans within the project area is presented in Figure 4.

4.2.1 Port Sites

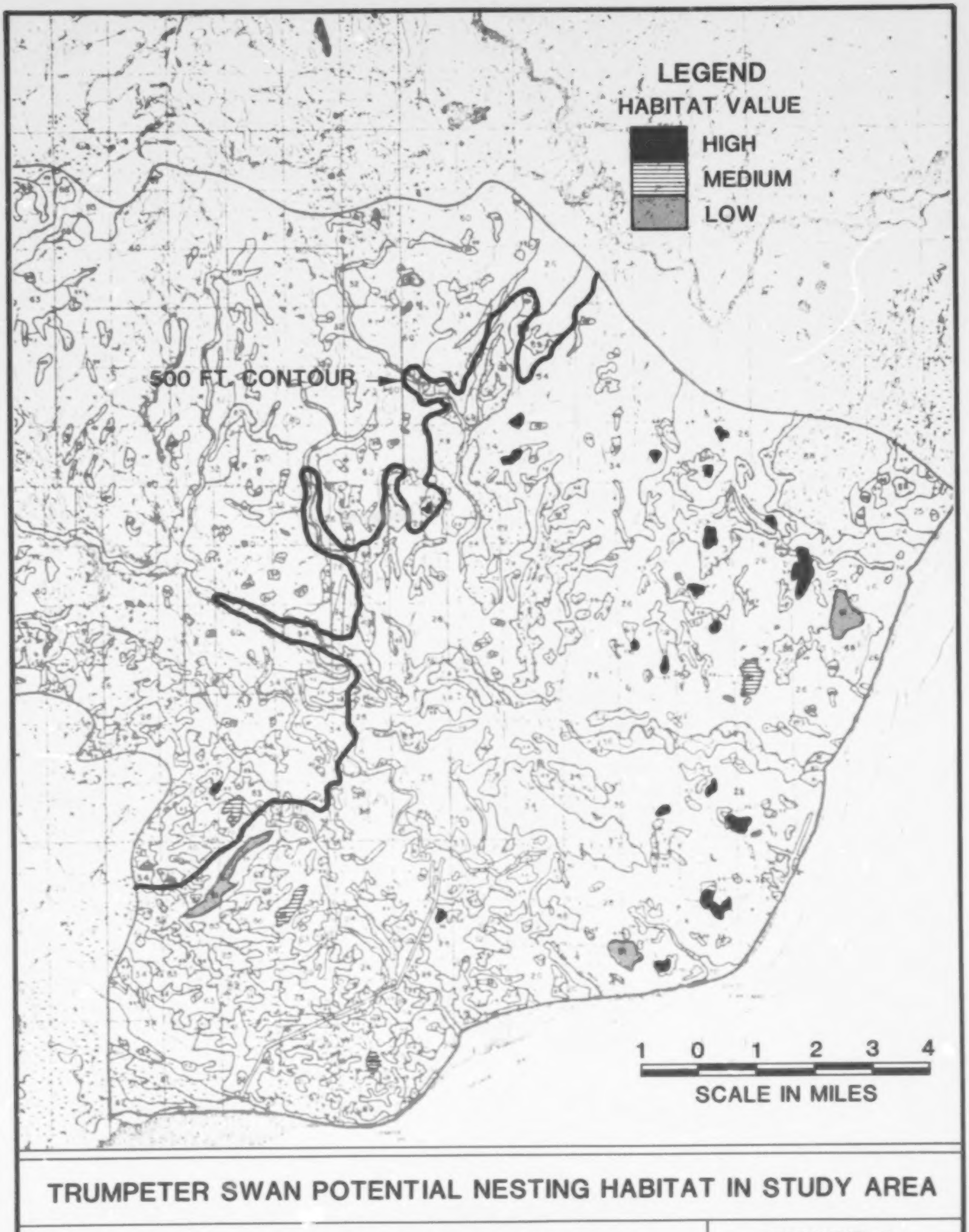
No swan nesting habitat was identified in the area of the Granite Point port site. Some wetland types could conceivably be used by non-breeders but this would be only to a very small degree because of the lack of open water bodies. These wetland types were classified as "not utilized".

At the Ladd port site, two small ponds will be directly affected by the proposed development. The smallest is below the minimum size for swan nesting habitat, but the larger one would be classified as high quality. Another small lake just north of the port, also high quality, would be indirectly affected by the development of this site.

4.2.2 Transportation Corridors

Only two lakes within the southern transportation corridor were classified as having a high suitability for trumpeter swans (Figure 4). However, both lakes are near the 152 m (500 ft) elevation which may limit their use for swan breeding in years with late springs. A total of three lakes within the corridor were classified as moderate value based primarily on their size. The largest lake, Congahbuna Lake, ranked low because it is larger than the size preferred by swans. It may be used for feeding by non-breeders since aquatic and emergent vegetation is plentiful at the south end of the lake.

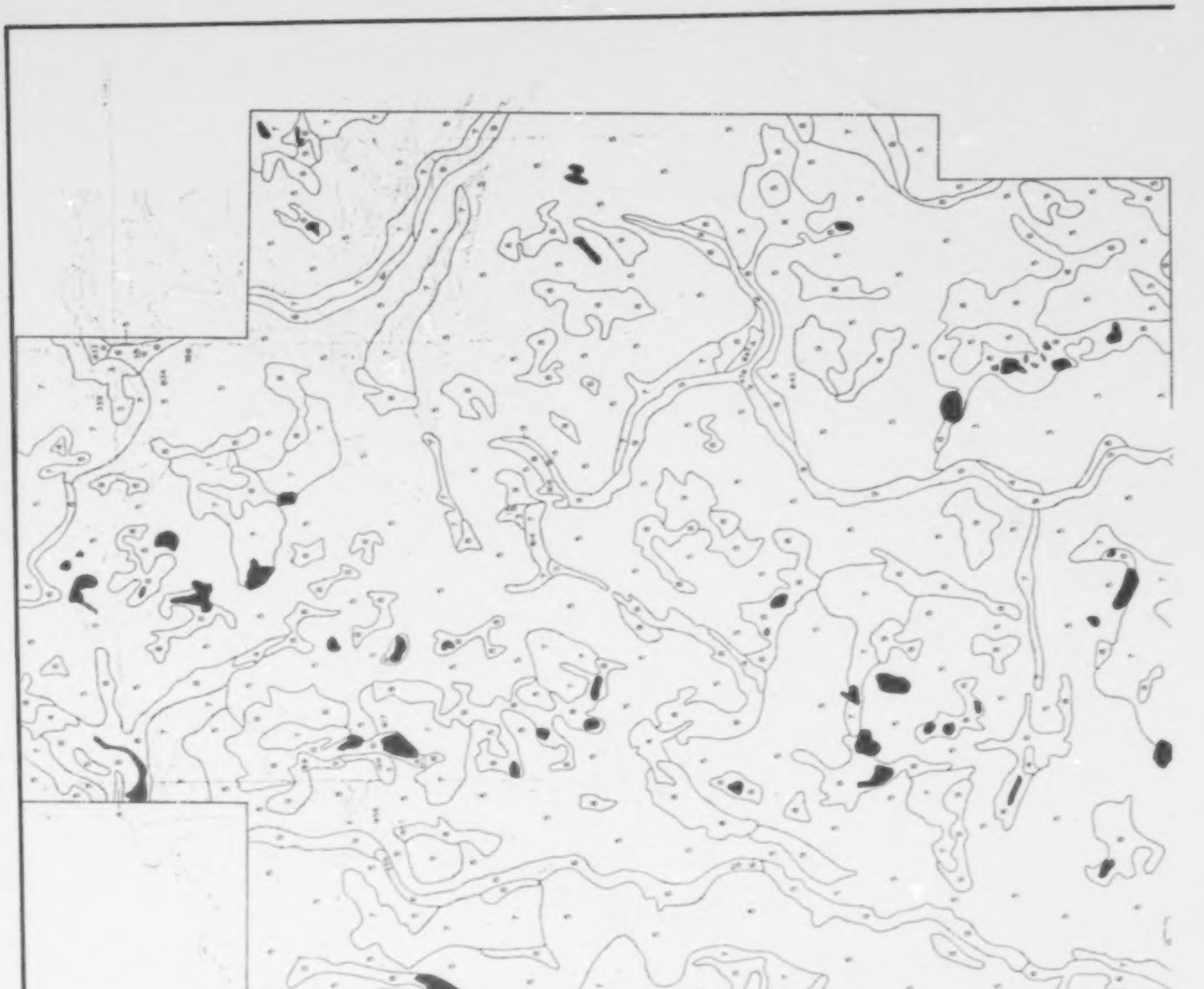
Two small lakes and one large lake, Chuitbuna Lake, within or adjacent to the eastern corridor were considered potential swan nesting habitat. Although a final route selection would likely go around these lakes, indirect impact from disturbance would likely make it unsuitable for nesting.


LEGEND
HABITAT VALUE
HIGH
MEDIUM
LOW
500 FT. CONTOUR
1 0 1 2 3 4
SCALE IN MILES

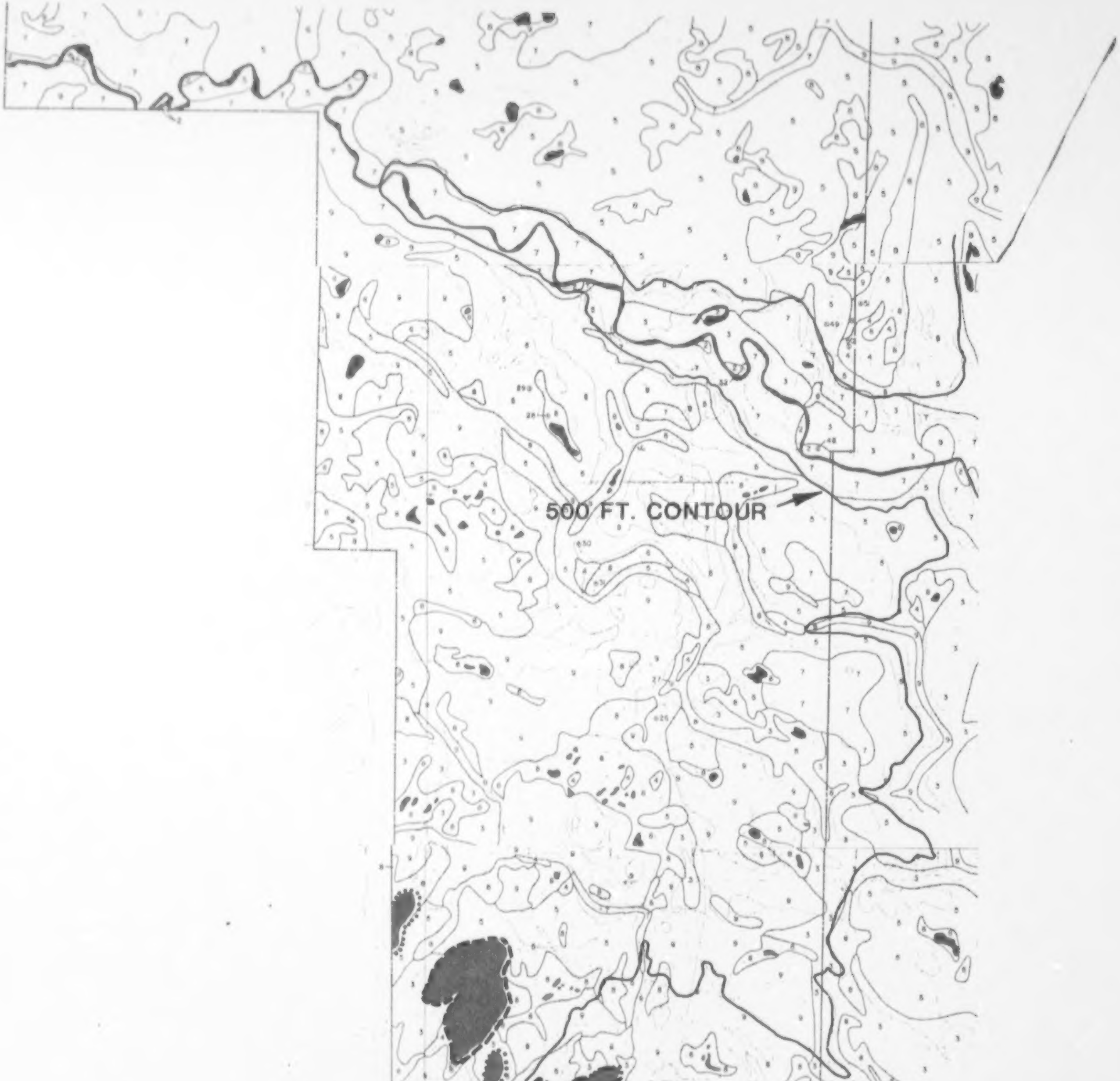
TRUMPETER SWAN POTENTIAL NESTING HABITAT IN STUDY AREA

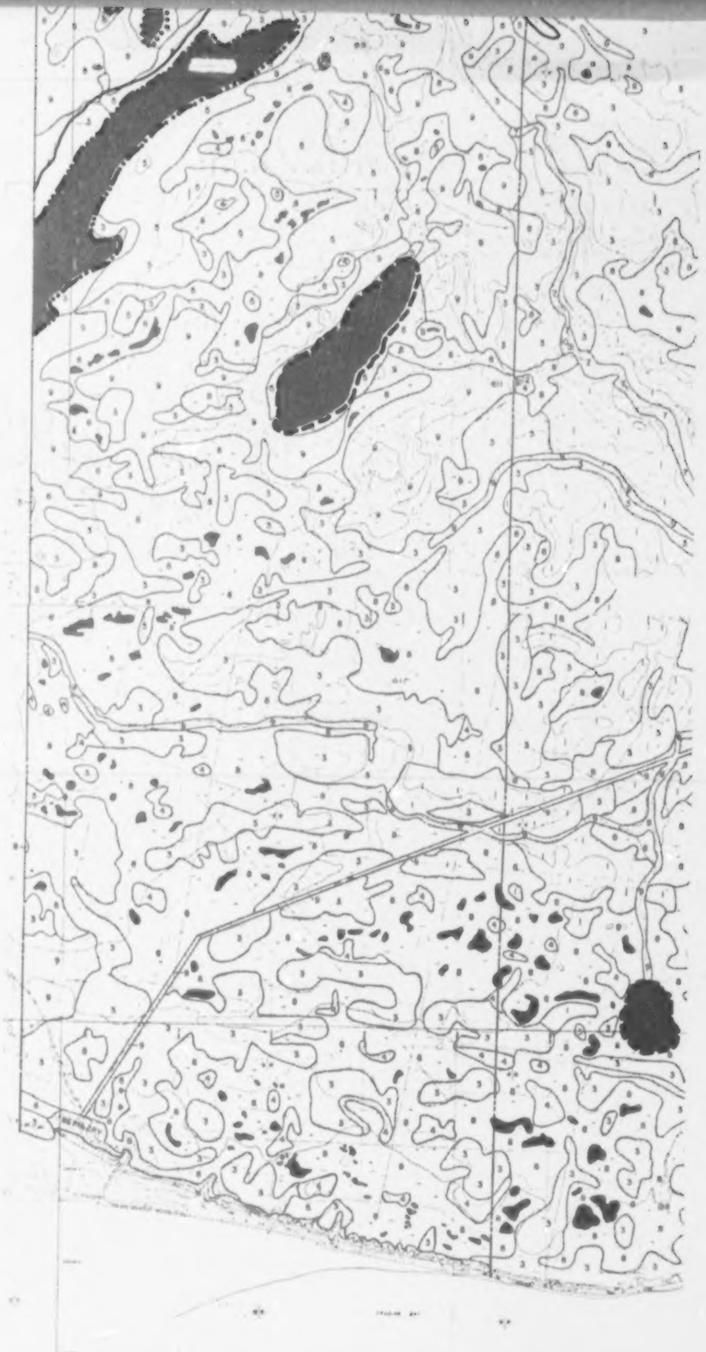
Diamond Chuitna Environmental Impact Statement

FIGURE 3



Aála


500 FT. CONTOUR


LEGEND
HABITAT VALUE
HIGH
MEDIUM
LOW
SCALE IN FEET
0
2000
4000
8000

TRUMPETER SWAN
POTENTIAL NESTING
HABITAT IN PROJECT AREA

Diamond Chuitna Environmental Impact Statement	FIGURE 4

Three large lakes and 4 small lakes adjacent to the northern transportation corridor appear to provide some degree of nesting habitat for swans. The largest, Viapan Lake, would be classified as low quality due to its large size, 100 ha (250 ac). Tukallah Lake, on Threemile Creek, would be ranked medium primarily due to its size (39 ha [96 ac]) but it could be used by non-breeding swans for feeding. Four small unnamed lakes adjacent to this route would be classified as high quality for nesting swans.

None of these habitats would be directly affected by the road or conveyor system.

4.2.3 Mine and Mine Facilities

No suitable habitat for breeding swans was located in the mine area. The primary limiting factor is the low number of ice-free day due to the elevation of the mine area. Non-breeding swans may be seen in some open water areas of the mine site during the summer but use is likely to be insignificant.

4.2.4 Airport and Housing Facilities

No suitable swan habitat occurs within the Lone Creek site or the Threemile site.

The Congahbana Lake site is adjacent to high, medium, and low quality swan nesting habitat but direct habitat loss would be minor (about 2 ha [5 ac]) depending on the exact site. Indirect impacts from disturbance would be significantly greater than actual habitat loss.

4.2.5 Material Sites

No suitable swan habitat occurs within Sites 5 and 7.

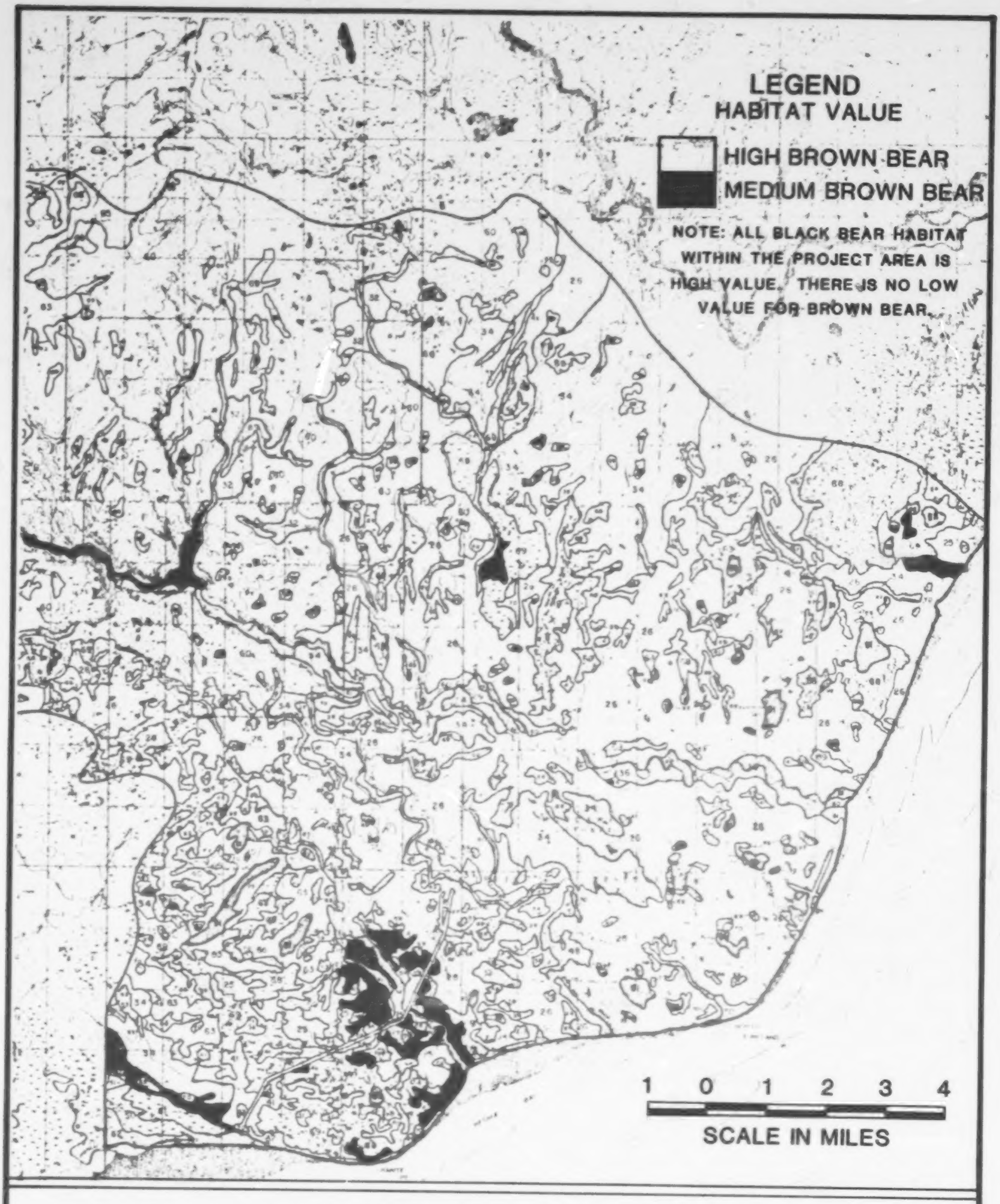
Site 8 is adjacent to medium quality swan habitat but no direct loss of habitat is expected from its development.

4.3 BLACK BEAR

None of the habitat types located within the project area were found to be limiting as far as availability of forage species. Cover was also found to be adequate throughout the project area with the exception of some grasslands west of Congahbuna Lake which are farther than 400 m (400 yd) from escape cover (Figure 5 and 6).

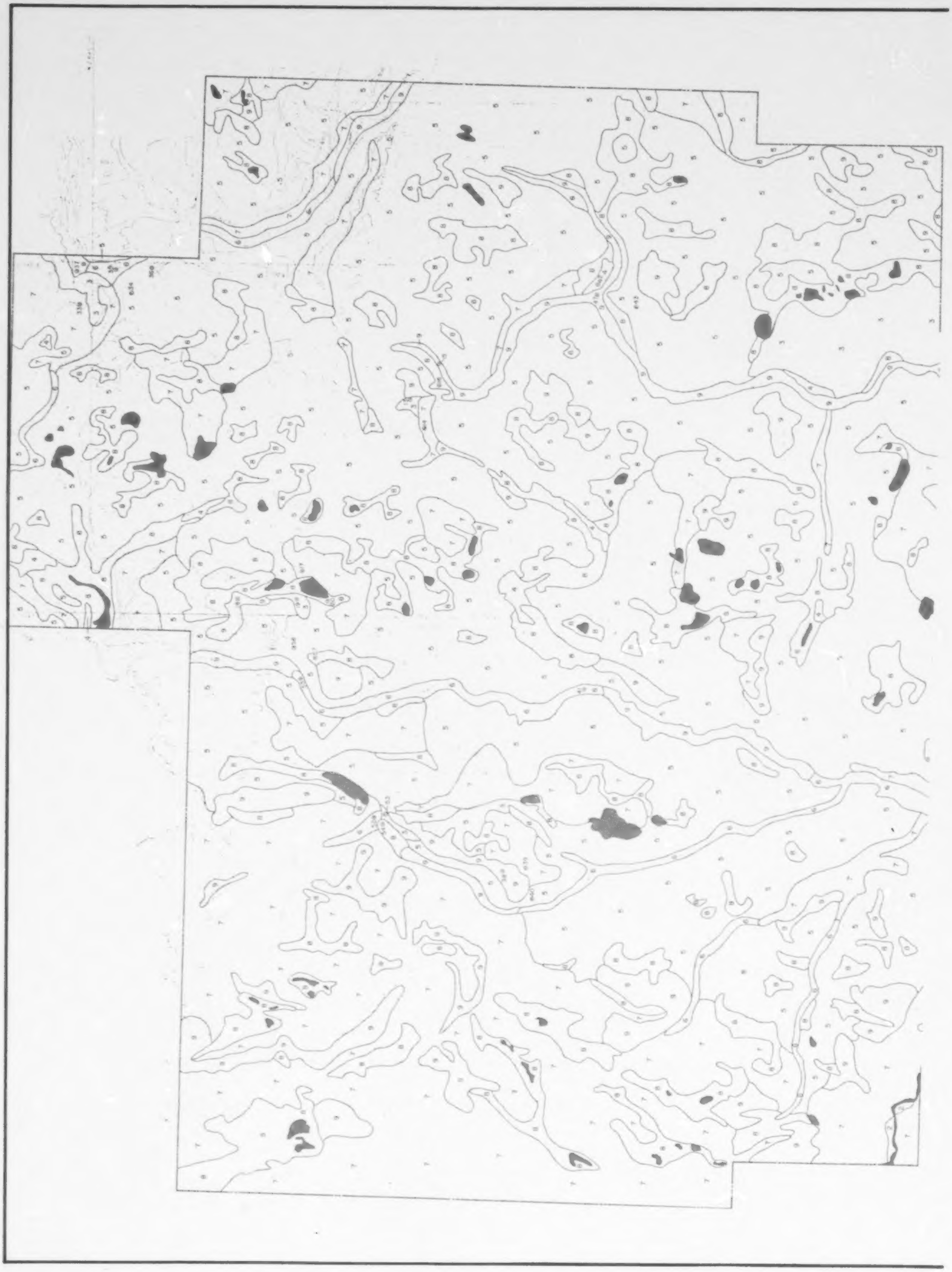
4.3.1 Port Areas

All habitat types within the proposed Granite Point port site were classified as having high value for black bear as were habitats within the Ladd site.

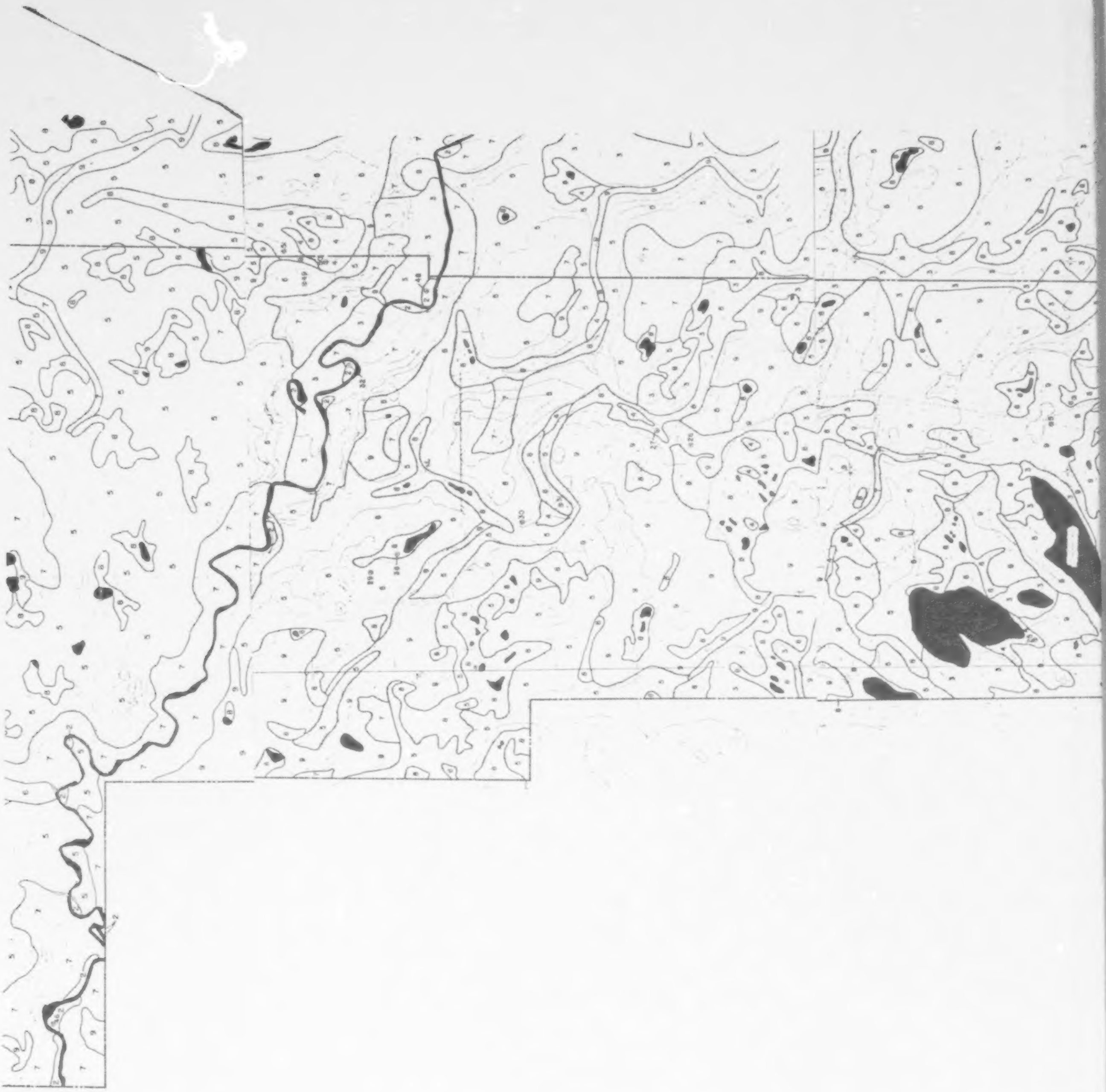

LEGEND
HABITAT VALUE
HIGH BROWN BEAR
MEDIUM BROWN BEAR
NOTE: ALL BLACK BEAR HABITAT WITHIN THE PROJECT AREA IS HIGH VALUE. THERE IS NO LOW VALUE FOR BROWN BEAR.
1 0 1 2 3 4
SCALE IN MILES

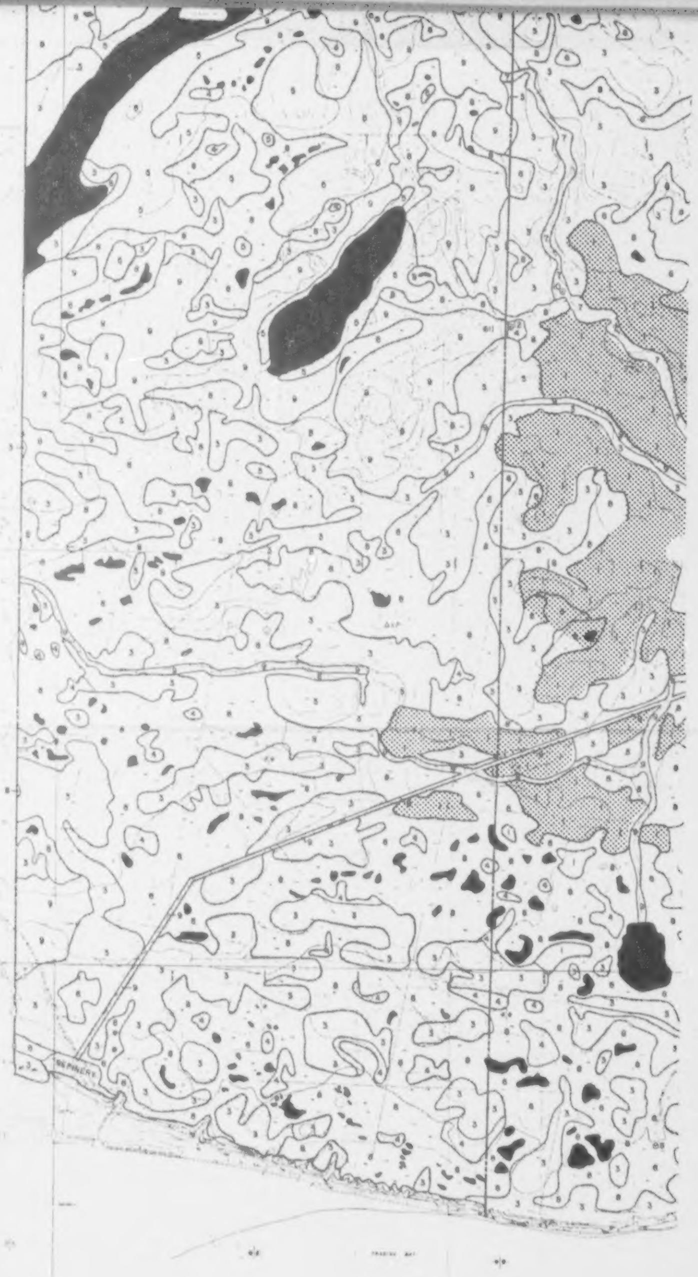
BLACK BEAR AND BROWN BEAR HABITAT IN STUDY AREA

Diamond Chuitna Environmental Impact Statement | **FIGURE 5**



A24a





LEGEND

HABITAT VALUE

☐ HIGH BROWN BEAR

▨ MEDIUM BROWN BEAR

NOTE: All black bear habitat within the project area is high value. There is no low value for brown bear.

SCALE IN FEET

0 2000 4000 8000

BLACK BEAR AND BROWN BEAR HABITAT IN PROJECT AREA

Diamond Chuitna Environmental Impact Statement	FIGURE 6

A24c

4.3.2 Transportation Corridors

All habitat types within the southern, eastern, and northern transportation corridors were classified as having high suitability for black bear.

4.3.3. Mine and Mine Facilities

All habitat types were classified as high value except for open water areas.

4.3.4 Airport and Housing Facilities

Within the area of the proposed Lone Creek site, all habitat which would be lost was classified as having high suitability for black bear. The same was true for the Congahbuna Lake site and Threemile site.

4.3.5 Material Sites

Material sites 5, 7, and 8 were all considered to contain high quality black bear habitat.

4.4 BROWN BEAR

The only habitat type within the project area which was found to be limiting for forage species and cover was the closed broadleaf forest/paper birch. This forest type has a relatively low percentage of berry-producing species and herbaceous forage species. Tree canopy cover is over 60 percent and the habitat was classified as having a medium overall suitability (Figures 5 and 6).

Bear densities are likely higher in the mine area since brown bears prefer open areas in the higher elevations.

4.4.1 Port Areas

All habitat types with the area to be developed at the proposed Granite Point and Ladd port sites were classified as having high overall habitat suitability for brown bear except for a small amount of open water habitat at the Ladd port site.

4.4.2 Transportation Corridors

Ninety-seven percent of the area to be developed within the southern corridor was classified as having a high overall suitability for brown bear. The remaining 3 percent was closed paper birch forest with a medium habitat suitability value.

All habitat types within the northern and eastern corridor were classified as high quality for brown bear.

4.4.3 Mine and Mine Facilities

All of the terrestrial habitat within the 30-year limit of the mine, the mine facilities, and overburden stock piles areas were considered to have a high overall habitat value for brown bears and provide good interspersion of habitat types. Open water areas, primarily pond habitats, were considered low quality habitat but were not delineated on the maps since all are relatively small. Total areas of aquatic habitat were approximately 24 ha (59 ac).

4.4.4 Airport and Housing Facilities

All habitats which would be lost in development of the Lone Creek site were classified as having a high overall suitability for brown bear, as were those in the Congahbuna Lake site and Threemile site.

4.4.5 Material Sites

All habitats within the three material sites were classified as high quality brown bear habitat.

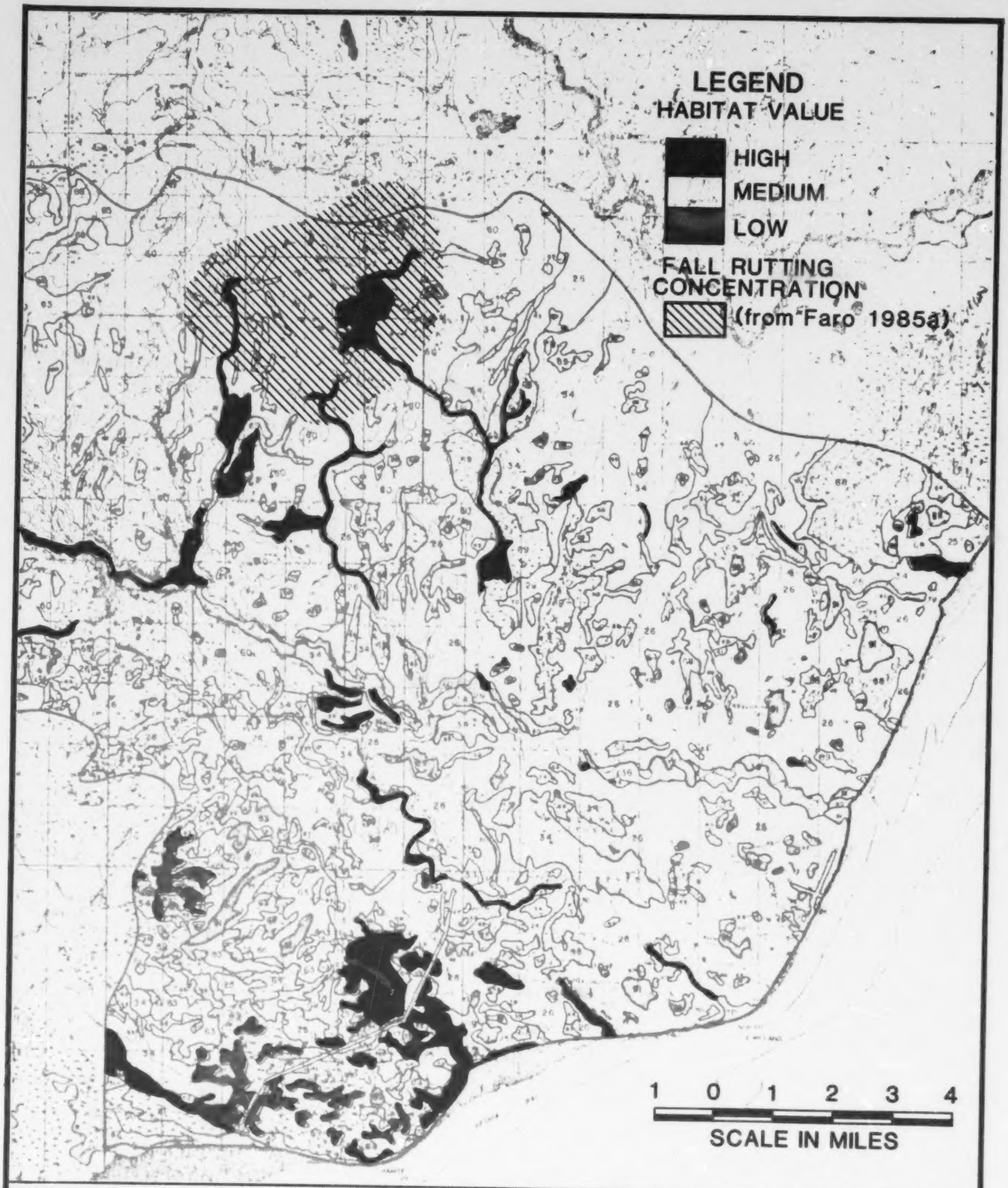
4.5 MOOSE

A higher degree of resolution was achievable in delineating quality of moose habitat in the project area than for the other species. This was largely due to the discrete habitat requirements of moose and the greater amount of available information on their habitat requirements.

Suitable spring/summer/fall range for moose is abundant throughout the project area and does not appear to be a limiting factor for the local population. Suitable habitat is found in low-lying areas which provide browse and herbaceous vegetation in the spring and early summer prior to the snow melt in the higher elevations. Once the upper areas are free of snow, moose can move up into extensive areas of high quality summer and fall range north of the Chuitna River (Figures 7 and 8).

Moose winter range is restricted to areas where snow accumulation does not limit availability of browse or mobility. The 152 m (500 ft) contour was used in this area as the upper elevation limit. The distribution of moose winter range in the study area and project area is given in Figures 9 and 10.

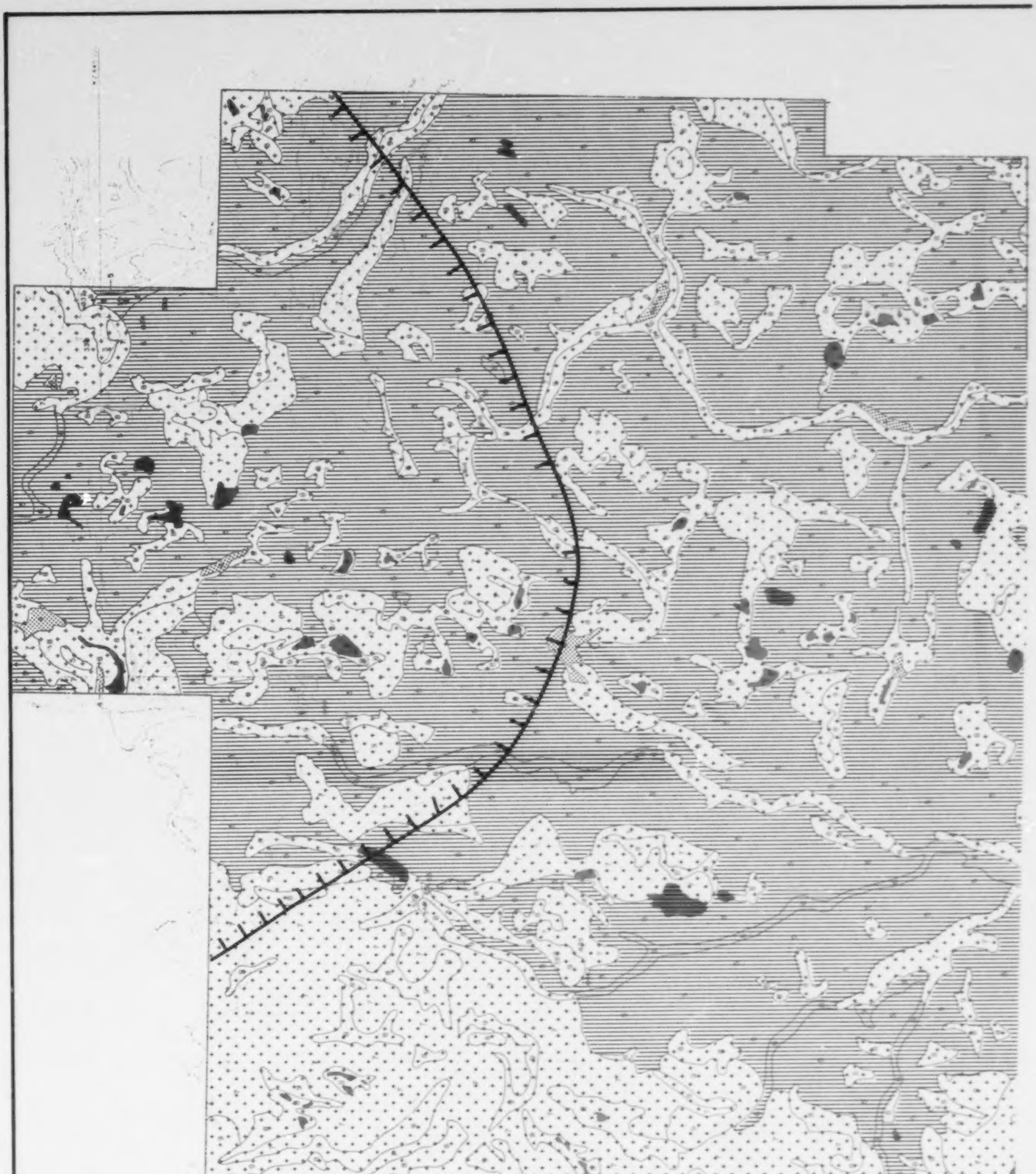
Some riparian areas very likely receive use disproportional to the size of the habitat areas. This may occur along both the Chuitna River and stream 2003.


LEGEND
HABITAT VALUE
HIGH
MEDIUM
LOW
FALL RUTTING CONCENTRATION
(from Faro 1985a)
1 0 1 2 3 4
SCALE IN MILES

MOOSE SPRING/SUMMER/FALL RANGE IN STUDY AREA

Diamond Chuitna Environmental Impact Statement

FIGURE 7



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LEGEND

HABITAT VALUE

▥ HIGH

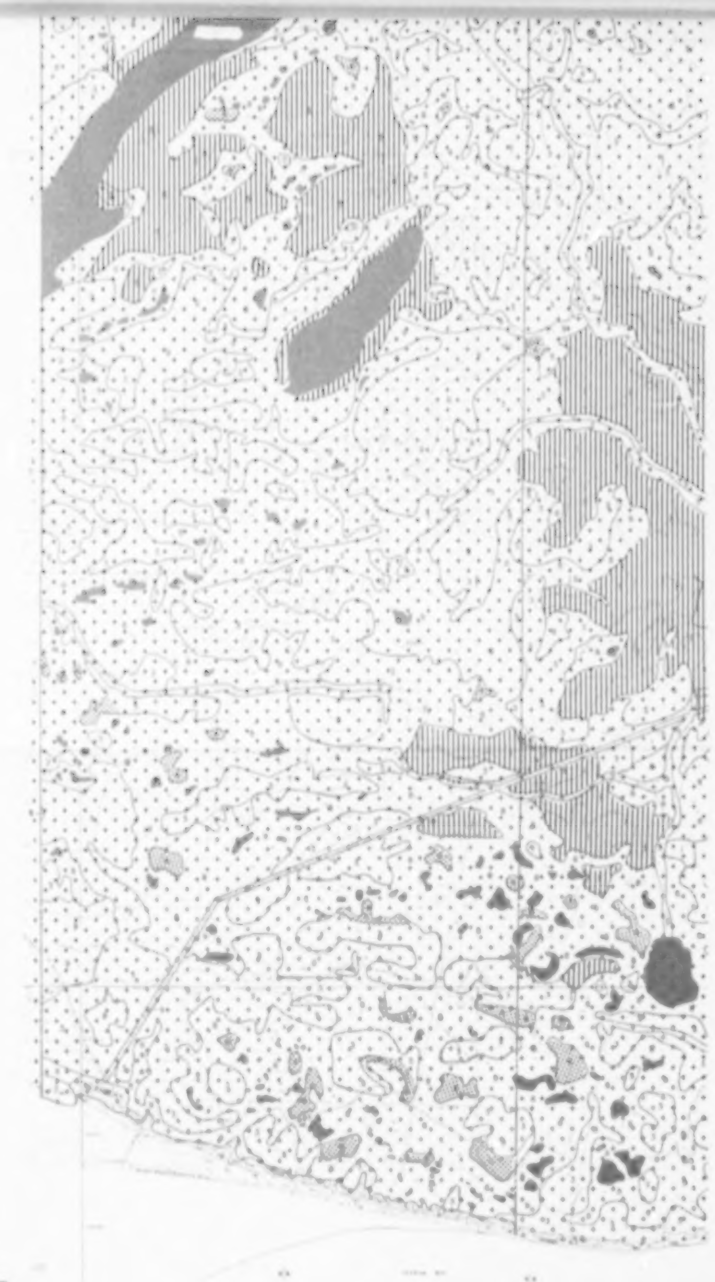
░ MEDIUM

▨ LOW

FALL RUTTING CONCENTRATION
(from Faro 1985a)

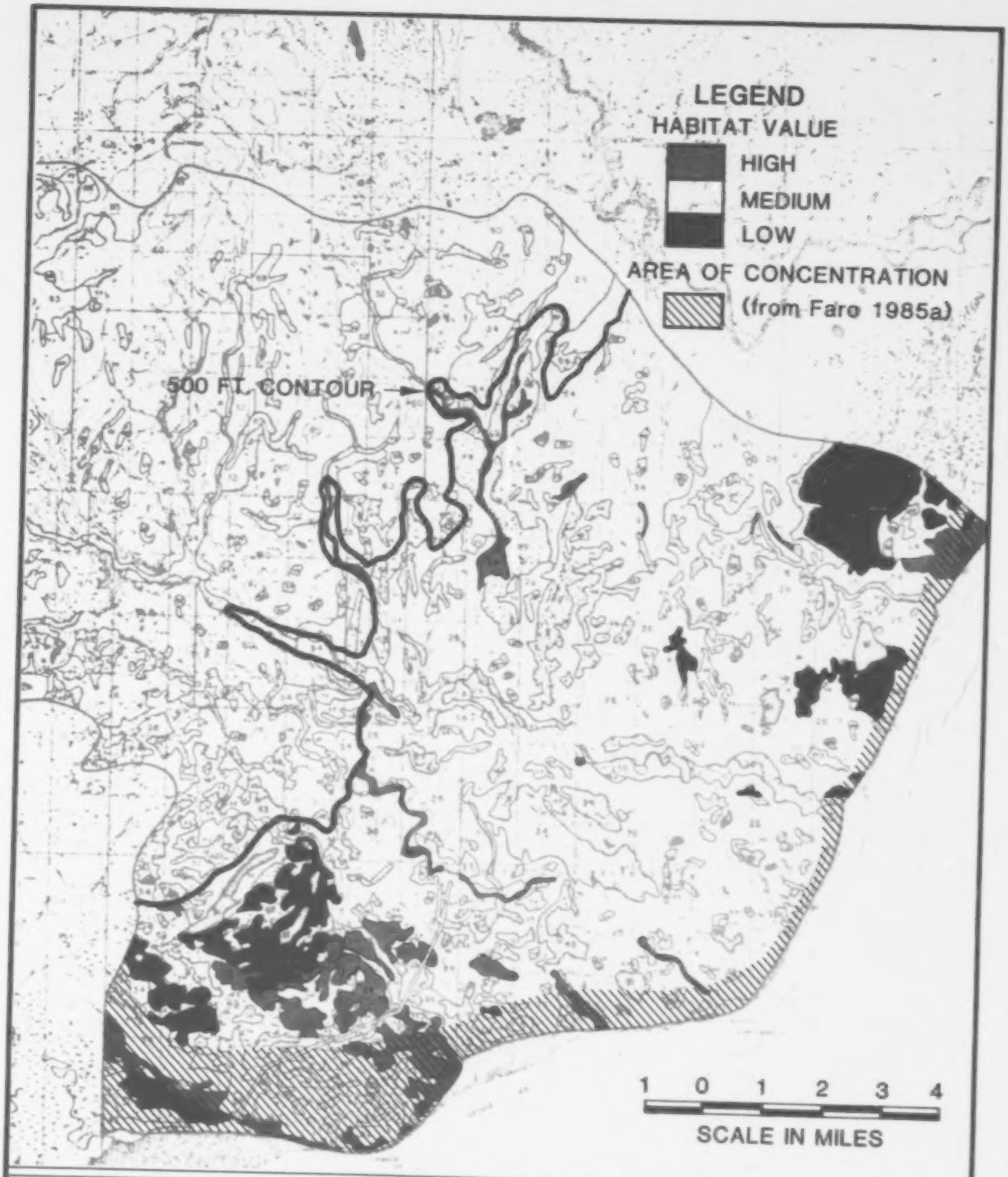
SCALE IN FEET

0 2000 4000 8000



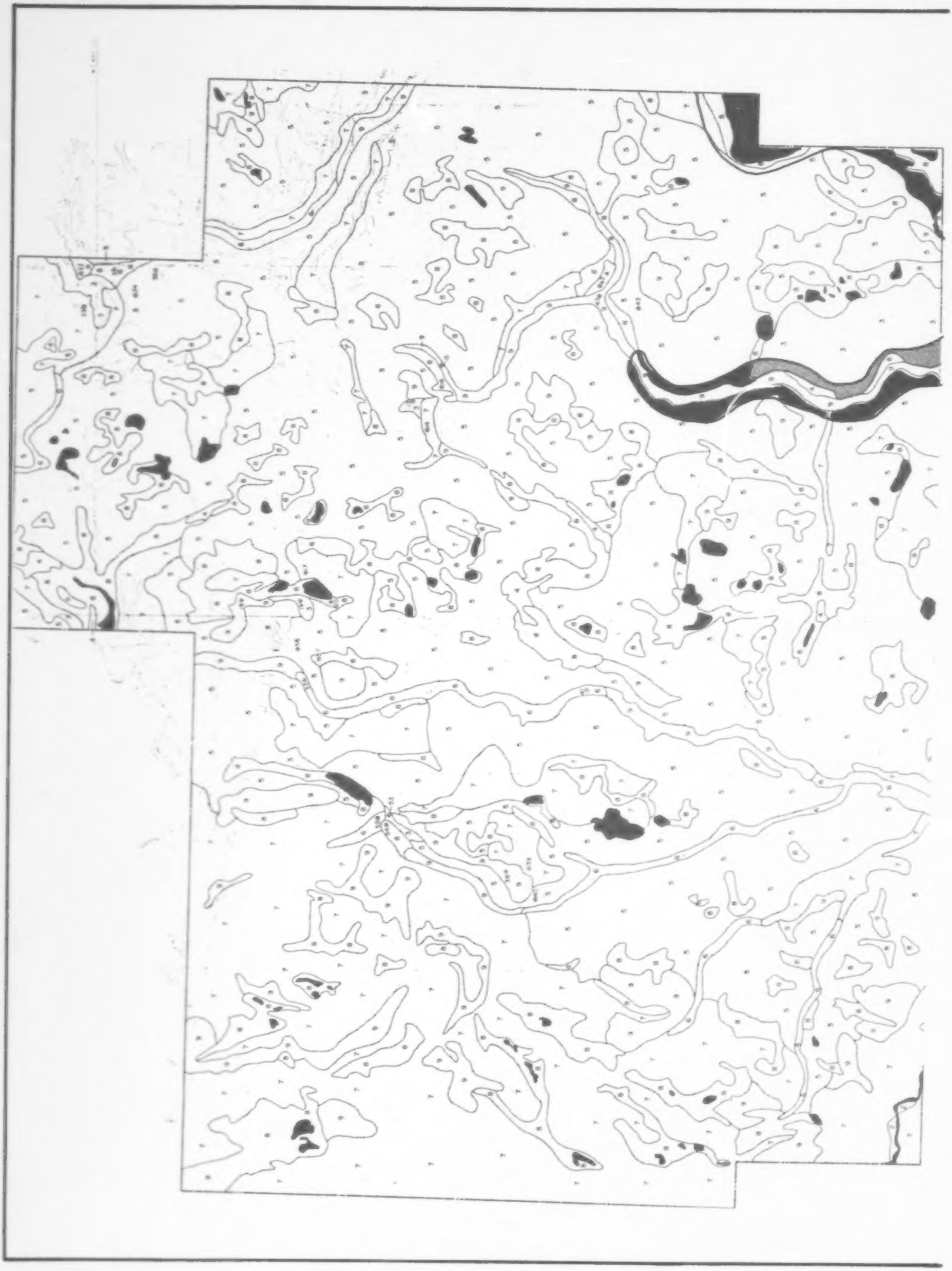
MOOSE SPRING/SUMMER/FALL RANGE IN PROJECT AREA

Diamond Chuitna Environmental Impact Statement	FIGURE 8


LEGEND
HABITAT VALUE
HIGH
MEDIUM
LOW
AREA OF CONCENTRATION
(from Faro 1985a)
500 FT. CONTOUR
1 0 1 2 3 4
SCALE IN MILES

MOOSE WINTER RANGE IN STUDY AREA

Diamond Chuitna Environmental Impact Statement | FIGURE 9



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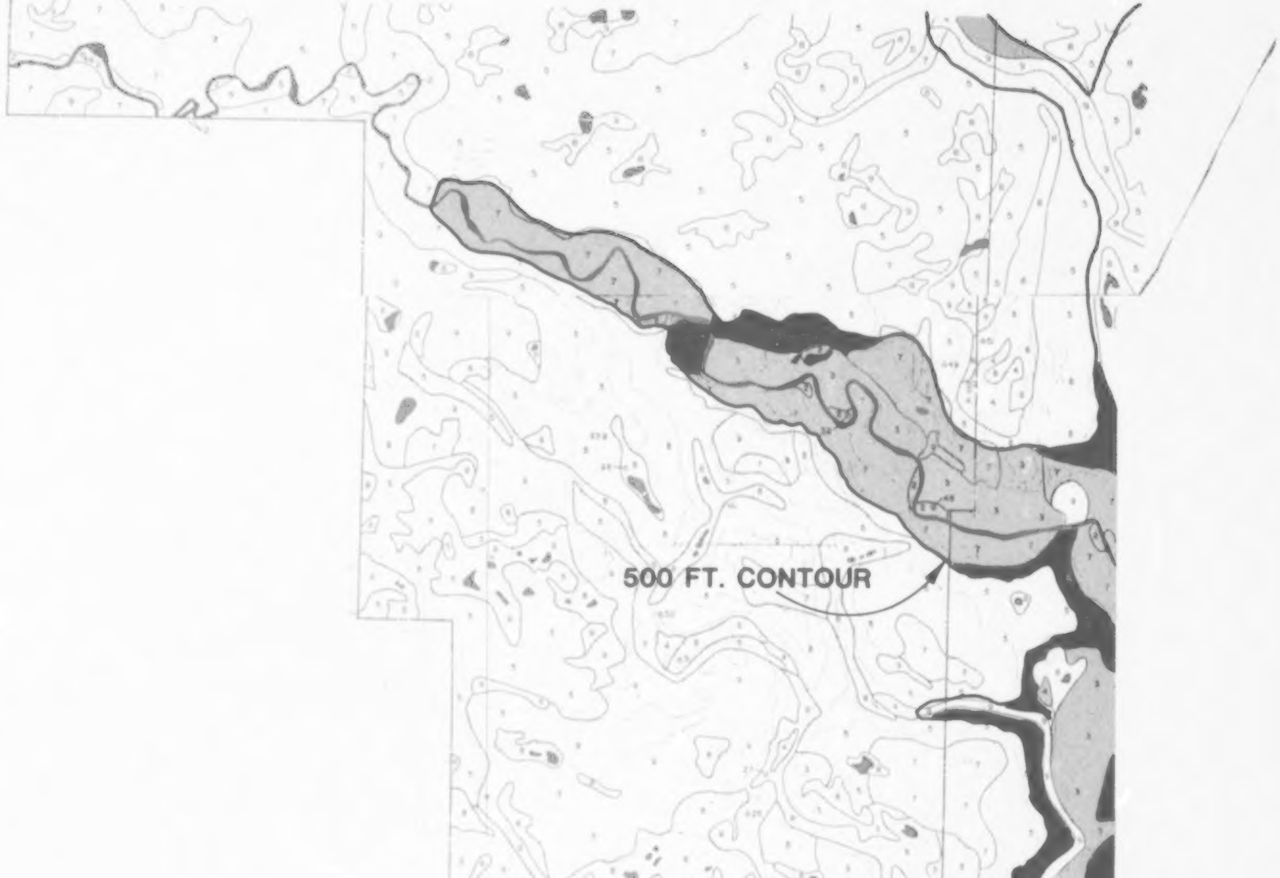
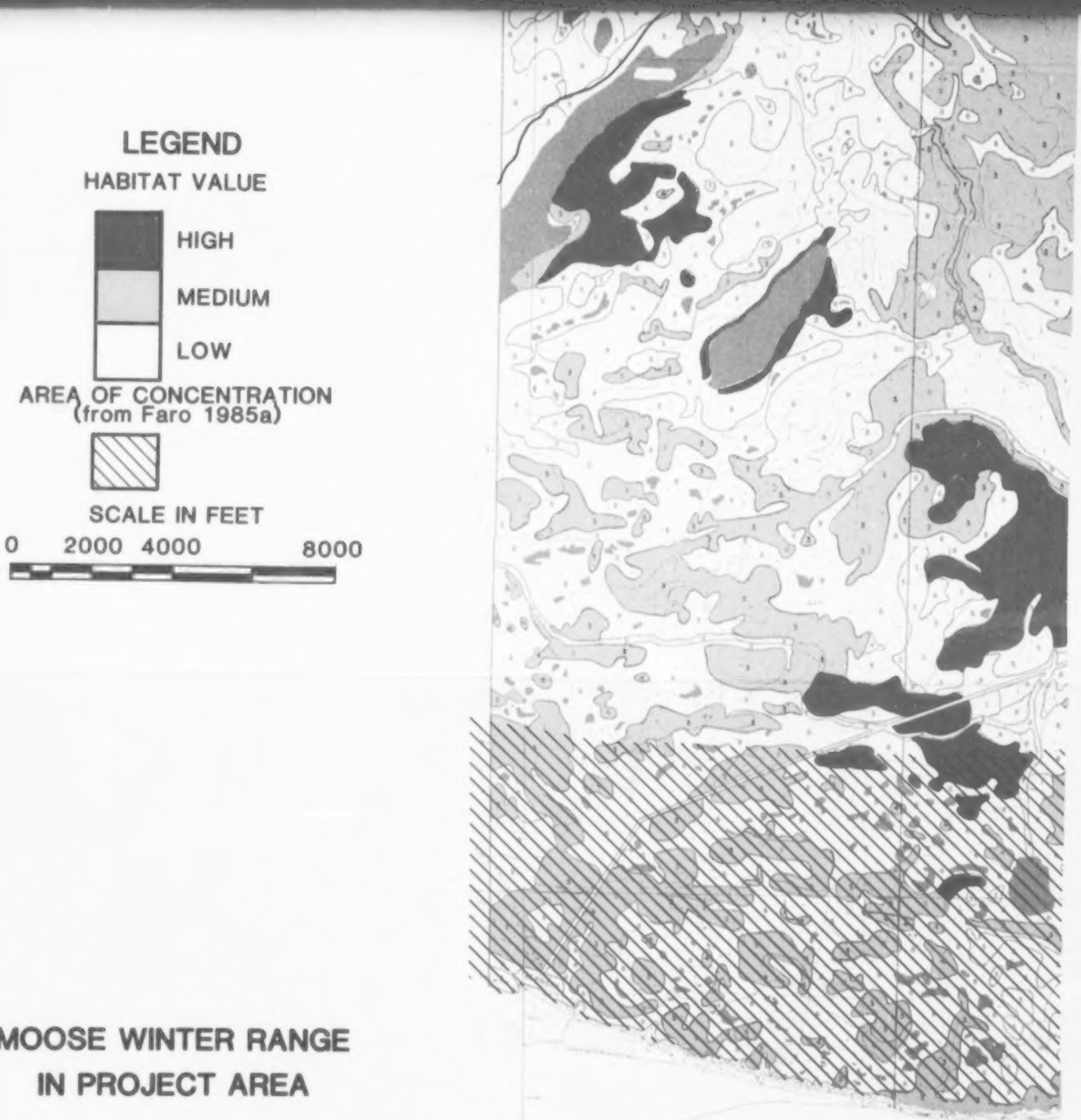

500 FT. CONTOUR


LEGEND
HABITAT VALUE
HIGH
MEDIUM
LOW
AREA OF CONCENTRATION (from Faro 1985a)
SCALE IN FEET
0
2000
4000
8000

MOOSE WINTER RANGE
IN PROJECT AREA

Diamond Chuitna Environmental Impact Statement	FIGURE 10

4.5.1 Port Areas

No areas of high suitability for either spring/summer/fall range or winter range occurred within the area to be developed at the proposed Granite Point port site. These areas would be characterized as having moderate spring/summer/fall values and low to moderate winter range value. It should be noted, however, that patterns of actual moose distribution in the winter (Figure 10) indicate high utilization of the coastal area including Granite Point which contradicts the results of the habitat modelling to some extent. Forage value of the habitat, which would be directly disrupted by port facilities, is probably low but the snow conditions and mix of habitats within the coastal strip as a whole is evidently favorable.

All of the habitat types in the Ladd port site (except for 3 ha [7ac] of open water) were classified as medium spring/summer/fall habitat. Only 6 ha (16 ac) were considered as having low value for winter range; the remainder received a medium rating. Actual utilization by moose in winter is probably high due to its proximity to the coast.

4.5.2 Transportation Corridor

The southern transportation system would affect a wide range of moose habitat. Moderate quality spring/summer/fall habitat would be the major type lost (67 percent) followed by high quality habitat (32 percent).

Winter range affected by the haul road and conveyor would largely be areas of low suitability (90 percent). High quality moose winter range lost to development amounts to one percent of the total lost along the corridor. Large areas of high suitability occur west of the proposed haul road.

The eastern corridor alignment would affect medium quality spring/summer/fall habitat to the greatest degree (93 percent) and high quality range to the lesser extent (7 percent).

No significant high quality winter range would be affected by the eastern route. Fifty-four percent of the route was classified as medium quality and 26 percent was low. Approximately 35 percent of the route would not be used due to its elevation (above 500 ft).

The northern corridor alignment would affect a relatively small amount of high quality moose spring/summer/fall habitat (5 ha [12 ac]) located along Lone Creek and Tributary 2003. These habitats are also considered high quality for winter range, but the high elevation (approximately 152 m [500 ft]) would likely preclude their use by moose. Most of the habitat affected by this route alignment

(93 percent) is of medium quality for moose spring/summer/fall use.

Forty-four percent of this corridor (32 ha [79 ac]) is of medium moose winter range with another 30 percent being classified as low quality.

4.5.3 Mine and Mine Facilities

Terrestrial habitats within the 30-year mine limit area are predominantly high quality moose spring/summer/fall range (67 percent) with most of the remaining area being of moderate quality. Less than one percent was classified as having low suitability. Since winter range was defined as areas below 152 m (500 ft) elevation, this area would contain no moose winter range. The possibility does exist that moose could use some of this area in winters of low snowfall or in early winter before significant snow accumulation. However, its significance as winter range would not be great over time.

4.5.4 Airport and Housing Facilities

A majority (86 percent) of the habitat lost in developing the Lone Creek site is classified as having a high overall habitat suitability for spring/summer/fall range but was not considered suitable for winter range due to the elevation. The remaining areas were considered of medium quality for moose summer range.

The moose habitat at the Congahbuna Lake site is predominately medium quality spring/summer/fall habitat but there is a significant amount of high quality habitat (34 percent). This area lies near the 152 m (500 ft) elevation so it is questionable whether moose are able to use the area in typical winters.

All of the habitat at the Threemile site is classified as being of medium quality for both moose spring/summer/fall habitat and for moose winter range.

4.5.5 Material Sites

A majority of habitats within material sites #5 and #8 provide high quality spring/summer/fall range for moose. Site #7 contains all high quality range. No low quality habitat was found within any of the areas proposed for use.

Sites #5 and #8 are too high in elevation to provide winter range in normal years. Site #7 is located on a south-facing slope above Nikolai Creek within a long band of high quality winter range. All of the habitat types at this site were characterized as high quality winter range.

4.6 COMPARISON OF PRE- AND POSTMINING HABITAT VALUE

4.6.1 Vegetation Types

The four major vegetation types which presently occur within the 10-year mine limit and overburden stockpile areas would be replaced by seven vegetation types during the reclamation process. Three of these vegetation types would be wooded types, only one of which, the mixed woodland, is presently found within the project area. These include: mixed woodland/spruce-birch, spruce woodland, and birch woodland. The mixed woodland/spruce-birch would be the most extensive type reestablished in the disturbed areas (Table 11). Smaller amounts of pure spruce stands and pure birch stands would replace some of the natural mixed woodland.

Three shrub types would be developed to replace the low shrub/sweetgale grass fen type. These include one natural type, closed tall shrub scrub alder, and two artificial types, open-tall shrub scrub/willow and open shrub scrub/mixed shrub.

The areas of vegetation types removed and replacement vegetation types are given in Table 11.

4.6.2 Habitat Values

The value of these replacement vegetation types for wildlife species would vary considerably depending upon several factors such as success of reestablishment, growth rates of the trees and shrubs, annual forage production and rates of natural introductions of native species. Habitat values would likely increase over time as the communities mature.

Since a major factor in determining habitat quality involves quantity of available forage (i.e., percent cover of berry-producing species) and this data is not available for the replacement vegetation types, the types cannot be evaluated using the criteria used for the overall habitat analysis. Only subjective values can be assigned based on plant species composition and professional judgment.

Sandhill cranes and trumpeter swans would not be affected by the mine development so black bear, brown bear and moose habitat only are discussed in this analysis.

4.6.3 Black Bear

The overall habitat value of all the revegetation community types would likely be medium due to the lack of diversity of succulent herbaceous understory species and berry-producing species, especially during the initial years after reclamation. Lack of mature trees or dense shrub

Table 11

COMPARISON OF AREAS OF HABITAT LOST TO MINING ACTIVITIES AND REPLACEMENT HABITAT

Vegetation Types[1]	Premining Habitat (hectares [acres])	Replacement Habitat (hectares [acres])
Mixed Woodland/Spruce Birch	398 (984)	222 (549)
Spruce Woodland	---	55 (137)
Birch Woodland	---	83 (206)
Mesic Graminoid Herbaceous/ Bluejoint Herb	34 (84)	125 (310)
Open Low Shrub Scrub/ Sweetgale-grass Fen	117 (291)	0
Open Tall Shrub Scrub/ Willow	---	24 (60)
Closed Tall Shrub Scrub/ Alder	105 (262)	104 (259)
Open Shrub Scrub/Mixed Shrub-grass	---	47 (118)
Open Water	7 (18)	0
Total	662 (1639)	660 (1639)

---

[1] It should be noted that premining and postmining habitat types that have the same name do not necessarily have the same composition or value to wildlife.

cover for escape may inhibit use until communities mature. Relative values of each replacement habitat are given in Table 12.

4.6.4 Brown Bear

Brown bears are a more wide-ranging species than black bears. Therefore, the effect of limited habitat on brown bear may not be as significant since the bears can compensate by using more suitable habitat outside the mine area.

Lack of diversity of forb and berry-producing species may decrease the quality of replacement vegetation types. However, since grasses would be a major component of most all types, this may compensate for the deficiency.

Since brown bears are primarily an open country species, habitat values of wooded types would decrease as they mature and develop a closed canopy.

4.6.5 Moose (spring/summer/fall range)

Snow depth during the winter would limit the mine area for moose winter range so use would occur during spring through fall.

The major habitat parameters determining the suitability of a vegetation type for moose during this time period are browse quality and quantity, availability of cover, and forb production.

Browse quality should be good in all woodland and shrub types with the possible exception of closed tall schrub scrub/alder but browse quantities are speculative at this point. The open tall shrub scrub/willow would be highest in habitat value; forb production would likely be low. In all, very few forbs would be introduced. Cover would likely not be a limiting factor affecting overall habitat quality.

4.6.6 Overall Habitat Quality

Surface areas of habitats according to value for key species are presented in Table 13 for both the premining and postreclamation condition using the assumptions developed above. Quality of the replacement habitat for wildlife within the 10-year mine limit would actually be highly dependent on the success of the reclamation and the succession of the new communities. It is suspected that replacement communities would provide lower quality habitat than the existing community types but would increase in value over time as the stands mature and resemble more closely premining diversity and forage species composition.

Table 12

RELATIVE HABITAT VALUE FOR REPLACEMENT HABITAT FOR BLACK BEAR, BROWN BEAR AND MOOSE

Replacement Community Type	Species Black Bear	 Brown Bear	 Moose
Mixed Woodland/ Spruce-Birch	Medium	High	Medium
Spruce Woodland	Medium	High	Medium
Birch Woodland	Medium	High	Medium
Mesic Graminoid Herbaceous/ Bluejoint Herb	Medium	High	Medium
Open Tall Shrub Scrub Willow	Medium	High	High
Closed Tall Shrub Scrub Alder	Medium	High	Low
Open Shrub Scrub/ Mixed Shrubs	Medium	High	High

Table 13

COMPARISON OF PREMINING AND POSTMINING HABITAT VALUES FOR EVALUATION SPECIES

Evaluation Species	Habitat Value	Premining Habitat (Hectares [acres])	Postmining Habitat (Hectares [acres])
Black Bear	High	660 (1639)	0
	Med	0	660 (1639)
	Low	0	0
Brown Bear	High	660 (1639)	660 (1639)
	Med	0	0
	Low	0	0
Moose Summer/Fall	High	398 (984)	71 (178)
	Med	257 (637)	485 (1202)
	Low	0	104 (259)

5.0 DISCUSSION

The terrestrial habitats of the Beluga area exhibit very high diversity and interspersion. The small amount of low quality habitat found for most species is an indication of the quality of this area. None of the habitat areas affected by the proposed development of the various components were classified as "very high" or critical to the species considered.

From the standpoint of direct habitat loss and quality of habitat, the southern transportation corridor to a port site at Granite Point and the housing facility and airport site at Lone Creek would produce the least adverse impact to wildlife habitat. The use of material site #5 would result in a smaller loss of habitat (especially for moose) than either #7 or #8. The Lone Ridge site was not considered in this analysis due to the remote possibility of its development.

The differences in direct habitat loss between alternatives is not significant compared to the large amount of habitat which would be lost within the 30-year mine limit.

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United States Department of the Interior
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Sunshine Plaza, Suite 2B
411 W. 4th Ave.
Anchorage, Alaska 99501

IN REPLY REFER TO:
WAES

Mr. William M. Riley
EIS Project Officer
U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101

16 SEP 1985

Re: Diamond Chuitna Coal Project
U.S. Fish and Wildlife Service (FWS)
Mitigation Policy Statement

Dear Mr. Riley:

As a part of overall planning and participation in the subject project, the FWS has prepared a mitigation statement for your information and guidance. This document, in accordance with the Fish and Wildlife Service Mitigation Policy (FR Vol. 46 No. 15, 23 January 1981), establishes fish and wildlife evaluation species, resource categories of habitat and mitigation goals.

By establishing project and species habitat specific mitigation goals, the FWS intends to protect and conserve the most important and valuable fish and wildlife resources while facilitating balanced development of the nation's natural resources.

Sincerely

Robert Bowker

Field Supervisor

Enclosure

cc: Don McKay, ADF&G, Anchorage
Jim Hemming, Dames & Moore, Anchorage
Brad Smith, NMFS, Anchorage
Rich Sumner, EPA, Anchorage
Sam Dunaway, DNR, Anchorage
Carol Gorbics, CE, Anchorage
Dan Wilkerson, DEC, Anchorage
Luke Frawelin, Diamond Chuitna, Anchorage

Diamond Chuitna Coal Project

Mitigation Statement

Under the Fish and Wildlife Coordination Act (FWCA) and the National Environmental Policy Act (NEPA) regulations, the Fish and Wildlife Service (FWS) has responsibilities to insure that project-related losses to fish and wildlife resources are identified and mitigated. As part of our participation in the planning and evaluation of the Diamond Chuitna Coal Project, the following mitigation statement has been developed in accordance with the FWS Mitigation Policy (FR Vol. 46, No. 15, 23 January 1981) and in consultation with the National Marine Fisheries Service (NMFS), the Environmental Protection Agency (EPA), and the Alaska Department of Fish and Game (ADF&G). It has been prepared to provide guidance for evaluating and mitigating impacts of the proposed project to fish and wildlife.

The Diamond Chuitna Coal Project mitigation statement has been developed by first selecting fish and wildlife habitats from among the full range of habitats occurring within the area to be impacted by both direct and indirect perturbations. These were chosen either because they represent resources which are most characteristic of the area or because FWS has mandated responsibilities for them. By narrowing the scope in this way, the analysis can focus on areas where significant changes are most likely to occur and not be unduly burdened by inclusion of areas with low fish and wildlife value.

Evaluation species, which function as indicators of habitat quality and quantity, were chosen. Selection of evaluation species has an important role in determining the extent and type of mitigation to achieve. A combination of two sets of criteria is typically used to choose species for this purpose. The first is to pick species with high public interest, subsistence, or economic values, and the second is to select species which use habitats of significant ecological value.

Fish and wildlife habitats were then assigned to one of the four Resource Categories delineated in the FWS Mitigation Policy (Table 1). Designation of habitat into Resource Categories ensures that the level of mitigation recommended is consistent with the value of that habitat and its relative abundance on a regional or national basis.

Eleven species have been selected as the basis for evaluating impacts and formulating mitigation requirements for the Diamond Chuitna Coal Project. Available information indicates that moderate to high value habitat for each evaluation species is found within the project area but that none is considered unique or irreplaceable. Therefore, the habitats for all species have been assigned to Resource Categories 2, 3 or 4.

The determination of the relative scarcity or abundance of habitat from the national perspective is based upon (1) the historical range and habitat quality and (2) the current status of that habitat. A significant reduction in either the extent or quality of habitat for an evaluation species indicates that it is scarce or becoming scarce, while maintenance of historical quantity and quality is the basis for considering it abundant.

Specific ways to achieve the mitigation goal for Resource Category 2 when loss of habitat value is unavoidable include:

> (1) physical modification of replacement habitat to convert it to the same type which was lost; (2) restoration or rehabilitation of previously altered habitat; (3) increased management of similar replacement habitat so that the in-kind value of lost habitat is replaced; or (4) a combination of these measures. By replacing habitat value losses with similar habitat values, populations of species associated with that habitat may remain relatively stable in the area over time.[1]

The mitigation goal of in-kind replacement of lost habitat, however, cannot always be achieved. When opposition to a project on that basis alone is not warranted, deviation from this goal may be appropriate. Two such instances occur when either different habitats and species available for replacement are determined to be of greater value than those lost, or when in-kind replacement is not physically or biologically attainable in the ecoregion. In either case, replacement involving different habitat kinds may be recommended, provided that the total value of the lost habitat is compensated.

For Resource Category 3, in-kind replacement of lost habitat is preferred, though not always possible. Substituting different habitats, or increasing management of different habitats so that the value of the lost habitat is replaced, may be ways of achieving the planning goal of no net loss of habitat value.

The planning goal associated with Resource Category 4 is to minimize the loss of habitat value. Resource Category 4 areas, possessing relatively low habitat values, have the greatest potential for improvement; their enhancement may be used to mitigate losses in resource categories 2 and 3.

---

[1] FWS Mitigation Policy.

Table 1. Resource Categories and mitigation planning goals.*

Resource Category	Designation Criteria	Mitigation Planning Goal
1	Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.	No loss of existing habitat value.
2	Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section.	No net loss of in-kind habitat value.
3	Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis.	No net loss of habitat value while minimizing loss of in-kind habitat value.
4	Habitat to be impacted is of medium to low value for evaluation species.	Minimize loss of habitat value.

* FWS Mitigation Policy (FR Vol. 46, No. 15, 23 January 1981).

Table 2. Evaluation species for the Diamond Chuitna Coal Project and Resource Category designations for associated habitat.

Common Name	Resource Categories of Associated Habitat
Sandhill crane	4
Trumpeter swan	2
Black bear	3
Brown bear	2
Moose	2/3*
Beaver	4
Belukha	3
Chinook salmon	2/3/4*
Coho salmon	2
Pink salmon	3/4*
Rainbow trout	3

*See text

Project Evaluation Species

1. Sandhill crane (Grus canadensis). The lesser sandhill crane, considered common on a national basis, nests throughout Alaska, as well as in northern Canada and the northeastern Soviet Union. Although uncommon in the Diamond Chuitna project area, cranes are abundant in Cook Inlet as summer breeders and as spring and fall migrants. Cranes nesting in Cook Inlet form part of the Pacific Flyway population.

Human use of Pacific Flyway cranes is primarily nonconsumptive (bird-watching and photography), although in Alaska cranes are hunted for sport and subsistence. Over 30 percent of the cranes harvested for sport in Alaska in 1982 were taken in Cook Inlet (Campbell 1984). Subsistence hunting, which occurs predominantly in the Yukon-Kuskokwim Delta, accounts for approximately 1000 birds every year (FWS 1983).

Boise (1977) found that "human activity above minimal levels appears incompatible with crane nesting, as reflected in nest desertion as a result of human activity. Loss of nesting habitat as a result of land development is a further threat to the population's stability."

Preferred nesting habitats are sedge/grass meadow and wet marsh tundra, with an unobstructed view on all sides and with standing water nearby (Konkel *et al*. 1980).

Because nesting has not been documented in the project area and because significantly better habitat can be found to the southwest and northeast (EPA 1985), the suitable crane habitat in the coastal reaches of the Diamond Chuitna project area is placed in Resource Category 4 (Tables 1 and 2).

2. Trumpeter swan (Olor buccinator). Nonconsumptive interest in this species is high. Recently close to extinction, the trumpeter swan is still very rare in the conterminous 48 states. Historically, swans were found throughout much of northcentral North America in summer and along the Mississippi River and the Atlantic, Pacific, and Gulf coasts in winter (Bartonek 1983). Their favorable response to management efforts and perhaps an amelioration in climate has made possible their removal from the Threatened and Endangered Species List. The 1980 census indicated that nearly 8,000 swans, or 90 percent of the world population, were on breeding grounds in Alaska (King and Conant 1981).

Swans nest and rear in the southern half of the state, in wetlands and shallow ponds and lakes surrounded by emergent vegetation. They are common migrants and breeders in Cook Inlet. The mine permit area contains one active nest, and the coastal reaches of the transportation corridors and ports fall within a broad band of nesting habitat. Trumpeter swan surveys in Cook Inlet indicate that the population is expanding (EPA 1985).

Trumpeter swans are very susceptible to disturbance while nesting and rearing cygnets, and the species is being excluded by recreational developments on large lakes formerly used for nesting (Timm and Woject 1978). Approximatey two thirds of all trumpeter swan habitat in Alaska is in private ownership and therefore potentially available for development. A key objective of the North American Management Plan for Trumpeter Swans is to "Preserve all current wintering and breeding trumpeter swan habitat through whatever means necessary to protect habitat integrity." Given this objective and the fact that the Alaskan population is expanding, all potential and actual nesting habitat in the Diamond Chuitna project area is placed in Resource Category 2.

3. Black bear (Ursus americanus). This species is widespread throughout North America; black bear habitat is considered abundant on both a national and regional basis. Human interest in black bears has always been high, particularly in terms of hunting, photography and wildlife observation. Black bears would be impacted by coal development through habitat elimination, reduction in food supply, increased human access and hunting.

Seasonal availability of foods strongly influences the distribution of black bears in an area. Bears move from spring green-up areas to summer salmon streams, and then to berry-producing shrubland in late summer or early fall. Black bears are common throughout the project area but prefer open, mixed hardwood/spruce forests at the lower elevations and do not range far from cover to feed. None of the habitats in the project area were found to be limiting in terms of food or cover and all were classified as being of high value for black bears (EPA 1985).

Because the study area provides good habitat and supports a large population of black bears, and because habitat in Cook Inlet is abundant, habitat in the project area is placed in Resource Category 3.

4. Brown bear (Ursus arctos). This species is considered a valuable big game animal and attracts numerous resident and nonresident hunters. It also elicits considerable nonconsumptive interest from photographers and wildlife observers. Although not considered threatened or endangered in Alaska, the brown bear is listed as threatened under the Endangered Species Act in the 48 conterminous states. As such, it is a species of national interest, whose habitat has been significantly reduced in extent and quality. It is considered scarce from the national perspective although it is relatively common in the project area.

Brown bears are distributed throughout the project area. They prefer open habitats and are most common in the upland shrub and tundra communities (EPA 1985). Brown bears have extensive home ranges, with seasonal changes in availability of food strongly influencing their movements. In spring and fall, the entire project area provides important forage habitat, whereas in summer and early fall the bears are drawn to the streams to feed on spawning salmon (Diamond Shamrock 1985). Nearly all of the project area was classified as being highly suitable as brown bear habitat (EPA 1985).

Project impacts to areas of early green-up, the salmon fishery, the berry-rich shrublands, and prey species will ultimately affect brown bears, as will more direct human disturbance in the form of easier access and increased hunting pressure.

Because of the national scarcity of the species and the high value of the habitat in the Diamond Chuitna project area, all of this habitat is placed in Resource Category 2 for brown bears.

5. Moose (Alces alces). Relative to its historic range, the species is considered abundant on both a national and regional basis. Historically, moose were an important source of food, clothing and implements along the major rivers. The species continues to be an important source of food and recreation, and is probably the most widely hunted species in Alaska. Spending by hunters results in benefits throughout the state's economy. The monetary value of moose is compounded by the number of nonresident hunters attracted to the state. Moose also have a high nonconsumptive value to photographers and wildlife observers.

Moose are an important evaluation species because they are common throughout the project area, particularly in the impacted riparian zones, and are generally responsive to mitigative habitat modifications. They will also be subject to increased hunting pressure during and after development of the project area.

Moose range throughout the project area. Calving takes place in the lowlands, where the cows and calves remain all summer, while bulls and cows without calves move to the upland tundra. The mine permit area covers most of an upland rutting area used every year by moose in the region. Snow brings the moose down to the lowlands; moose from the project area winter primarily in the vicinity of Granite Point (EPA 1985).

As moose habitat is nationally, regionally and locally abundant, and as habitat in the project area is predominantly of medium to high quality, most of the habitat in the project area is placed in Resource Category 3. The exception is the section of rutting area that overlaps with the mine permit area, placed in Resource Category 2 by virtue of its importance to the regional moose population.

6. Beaver (Castor canadensis). Abundant both nationally and regionally, beaver play important economic and ecological roles. Beaver trapping in Alaska continues to be an integral component of traditional lifestyles, providing a source of revenue for bush residents. Similarly, trapping provides recreational benefits to urban residents. Beavers have an important ecological function in modifying habitat, often in ways that benefit other fish and wildlife species such as coho salmon, waterfowl and moose. Beaver dams may impede the upstream migration of spawning salmon, particularly in years of low flow.

Beavers are common throughout the project area, along the major tributaries of the Chuitna and in backwater sloughs; concentrations are moderate and habitat is probably of medium value (Diamond Shamrock 1985). Because of the abundance on the national and regional level of beaver habitat comparable to that in the Diamond Chuitna project area, beaver habitat in the project area is placed in Resource Category 4.

7. Belukha (Delphinapterus leucas). While circumpolar in distribution, the belukha does not normally range south of Alaska. It is one of the most abundant cetaceans in the north Pacific. Belukhas are usually migratory, but the 300-400 whales in Cook Inlet constitutea nonmigratory, relatively isolated component of the population (USDI 1983). They feed on anadromous fish close to shore and at the mouths of rivers. The proposed Diamond Chuitna port facility may be in the middle of a belukha calving or nursery area (EPA 1985).

Given the indigenousness of the Cook Inlet belukha population and the probable importance of the Beluga River area as calving grounds, belukha habitat in the Diamond Chuitna project area is placed in Resource Category 3.

8. Chinook salmon (Oncorhynchus tshawytscha). Hydroelectric projects in the northwestern U.S. have destroyed a significant portion of the chinook spawning habitat in the conterminous 48 states. Because of the species' high commercial, recreational and subsistence values, there is considerable national and regional interest in minimizing losses to chinook populations and expanding existing stocks.

Chinook salmon support an important fishery in the Chuitna River system; three percent of the commercial catch in upper Cook Inlet comes from set net sites in the vicinity of the project area (EPA 1985). Chinook enter the Chuitna River in mid-June and spawn there and in the middle and lower reaches of streams 2002, 2003 and 2004. Although suitable spawning and rearing habitat is available in the upper sections of these streams, the upstream range of chinook has decreased in recent years, probably because access has been increasingly obstructed by beaver dams (EPA 1985). The Diamond Chuitna project would destroy chinook spawning and rearing habitat in these streams for an unknown length of time, through the mining of streambeds, increased sediment loads, and altered water flows and water chemistry.

Because of the national and local emphasis on chinook salmon and the ongoing loss of good habitat, chinook habitat in the project area that has been rated as high or very high quality (Chuitna River, 2002, middle and lower mainstem 2003, middle and loweer mainstem 2004) is placed in Resource Category 2; all medium-quality chinook habitat is placed in Resource Category 3 (upper mainstem 2003, 200304, 200305, upper mainstem 2004, 200403); and all habitat of low quality (200306) is placed in Resource Category 4 (EPA 1985).

9. Coho salmon (Oncorhynchus kisutch). On a national level hydroelectric development in the northwestern U.S. has resulted in a significant depletion of coho salmon stocks. The coho salmon is an important commercial and subsistence resource and a highly prized sport fish in Alaska. The average commercial harvest in 1980-1984 for upper Cook Inlet was 500,000 cohos, 7 percent of which were caught in the vicinity of the project area (EPA 1985).

Coho salmon spawn and rear throughout streams 2002, 2003 and 2004. Access to upper reaches does not appear to be limited by beaver dams, although beaver activity has altered spawning habitat in several tributaries, making it unsuitable for coho (Diamond Shamrock 1985). Additional destruction or degradation of coho habitat in anticipated as a result of mining in the project area.

Because of the species' national and regional importance and the increasing scarcity of good habitat, habitat in the Diamond Chuitna project area (all rated as being of high or very high quality; EPA 1985) is placed in Resource Category 2.

10. Pink salmon (Oncorhynchus gorbuscha). Historically, pink salmon were limited in range to coastal streams in northwestern Washington and to the north. As no significant reduction in that habitat has occurred, pink salmon habitat is considered abundant on a national and regional basis. The commercial, subsistence and sport value of this species is considered high. THe commercial catch in the coastal reaches of the project area is about six percent of the catch in upper Cook Inlet (EPA 1985).

Pink salmon spawning has been confined in recent years, possibly as a result of beaver dam obstructions, to the lower reaches of the Chuitna River and streams 2002 and 2003 (EPA 1985). Additional loss of habitat is anticipated as a result of coal mining in the project area.

Because of the abundance of pink salmon habitat nationwide, habitat in the project area of medium or high value is placed in Resource Category 3 (Chuitna River, 2002, mainstem 2003) and habitat of low value is placed in Resource Category 4 (200304, 200305, 200306, 2004; EPA 1985).

11. Rainbow trout (Salmo gairdneri). This species is one of the most sought-after sport fishes in North America, if not in the world. The original range of the rainbow trout is west of the Continental Divide from northern Mexico to the Kuskokwim River. Rainobw trout have been introduced to every continent except Antarctica. The species is now present in every state except Louisiana, Mississippi and Florida and has been introduced into several lakes in Alaska (Morrow 1980). Interest in this species on a national and state basis is high. Habitat is considered abundant in comparison to historic levels.

The rainbow trout population in the project area is judged to be in very good condition (ERT 1985). Juveniles are distributed throughout the tributaries in the project area, although they are most abundant in the Chuitna River, the lower mainstem of 2003 and the lower and middle mainstem of 2002. Adults are found in the mainstem of the Chuitna (EPA 1985, ERT 1985).

Although the area is capable of supporting a limited high-quality sport fishery, inaccessibility and lack of publicity have limited the sport harvest (EPA 1985). Increased human access, in conjunction with loss of habitat and prey, will have an impact on the rainbow population in the project area.

Because habitat in the project area is of medium to high quality and similar habitat is abundant on a local and national basis, rainbow trout habitat is placed in Resource Category 3.

11

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US Army Corps of Engineers
Alaska District

Regulatory Branch
Post Office Box 898
Anchorage, Alaska 99506-0898

Public Notice of Application for Permit

PUBLIC NOTICE DATE: July 15, 1988

EXPIRATION DATE: September 13, 1988

REFERENCE NUMBER: 2-850259
2-850260
2-850261

WATERWAY NUMBER: Cook Inlet 330
Cook Inlet 331
Cook Inlet 332

Interested parties are hereby notified that an application has been received for a Department of the Army permit for certain work in waters of the United States, as described below and shown on the attached plan.

APPLICANTS: Granite Point Coal Port, Incorporated (Granite Point port component) Tidewater Services Company (Ladd Port, transportation and housing components) Diamond Alaska Coal Company (mine component).

APPLICANTS' AGENT: Luke Franklin, Manager of Environmental and Regulatory Affairs, Diamond Alaska Coal Company, 550 West 7th Avenue, Suite 1900, Anchorage, Alaska 99501, (907) 276-6868.

LOCATION: The proposed project (known as the Diamond Chuitna Project) is located on the northwest side of Cook Inlet approximately 45 miles west of Anchorage in the Kenai Peninsula Borough near the village of Tyonek. The proposed project is comprised of four separate components: the Diamond Chuitna Mine, the Granite Point or Ladd (alternate) Coal Port, transportation systems, and housing facilities.

PORT FACILITY: Granite Point, Sections 22, 27, T. 11 N., R. 12 W., S.M., Ladd (Alternate) sections 19 and 20 T. 12 N., R. 10 W.

TRANSPORTATION CORRIDOR TO GRANITE POINT: Sections 3, 4, 10, 15, 22, 27, T. 11 N., R. 12 W., sections 3, 4, 10, 15, 22, 27, 34, T. 12 N., R. 12 W., S.M.

TRANSPORTATION CORRIDOR TO LADD (ALTERNATE): Sections 6, 7, 18, 19, and 20, T. 12 N., R. 10 W., section 31, T. 13 N., R. 10 W., sections 31, 32, 33, 34, 35, and 36, T. 13 N., R. 11 W., section 36, T. 13 N., R. 12 W., sections 2, 3, T. 12 N., R 12 W.

HOUSING FACILITIES: Section 14, T. 12 N., R. 12 W., S.M.

MINE FACILITY: Section 14-15, 21-28, and 33-36, T. 13 N., R. 12 W., S.M., section 4, T. 12 N., R. 12 W., S.M.

PURPOSE: Diamond Alaska Coal Company proposes to develop a twelve million ton per year coal Company mine in the Beluga region of upper Cook Inlet. Recoverable coal reserves are estimated to be a minimum of 330 million short tons.

BACKGROUND INFORMATION: The Environmental Protection Agency (EPA) is preparing an Environmental Impact Statement (EIS) for the Diamond Chuitna project. The Alaska District Corps of Engineers is a cooperating agency in the EIS.

A permit decision regarding this project will not be made until after the Final EIS has been prepared. This public notice reflects the applicant's preferred alternative as well as an alternate port site. Other alternatives being considered in the EIS process and a discussion of their impacts are found in the EIS. The surface mine would be located on State coal leases in the Chuitna River drainage approximately 12 to 15 miles north of Granite Point. Coal production is scheduled to start at 2 million tons per year with the planned maximum production of 12 million tons per year in the seventh year of operation. The project life would be approximately 34 years. The basic surface mining technique would utilize a combination of trucks, shovels, and draglines supported by the necessary complement of front end loaders, dozers, graders, and other equipment.

WORK: The proposed work can be described in four parts: port facility, transportation corridors, housing, and mine facility.

1. PORT FACILITY (GRANITE POINT COAL PORT, INCORPORATED, APPLICANT, 2-860259, Cool Inlet 330): The port facility would require approximately 198 acres for the construction of the port facilities. Approximately 173 acres of wetlands would be filled as needed for the coal stockpile of 400,000 to 1,200,000 ton capacity, sediment ponds and buildings. A total of approximately 3,360,000 cubic yards (cy) of material would be placed in wetlands.

The following structures would be placed in the onshore port area:

a. Service buildings to house shops, warehouse, change areas, general administration offices and interim storage for supplies.

b. Heliport including landing pad, maintenance facilities, hangar, office lounge and toilet.

c. Main electrical control building.

d. Fire and ambulance station.

e. Water treatment plant and storage.

f. Sewage treatment plant (port only).

g. Diesel fuel storage tanks for approximately four month supply to support port, transportation, and mining operations.

h. Gasoline storage tanks for approximately four month supply to support port, transportation, and mining operation.

i. Miscellaneous oil and coolant storage tanks to support port, transportation, and mining operations.

j. Containerized and miscellaneous storage for interim storage of materials and supplies.

k. Fuel distribution station.

l. Coal stockpile of 400,000 to 1,200,000-ton capacity with stacker/reclaimer, yard conveyor system, truck dump, hopper feeder system, coal haulage road, overland conveyor drive house, and transfer stations for overland conveyor to stockpile conveyor and stockpile conveyor to port (approach) conveyor.

m. Coal haulage road to transport coal prior to startup of conveyor operations, and several access roads to link various port facility components.

n. Electrical substation.

o. Power distribution system consisting of overland and underground powerlines to provide power for port equipment and distribute power to mine, transportation, and housing facilities.

p. Diesel fuel electric generating facility to support mine transportation system, port, and housing facilities.

q. All weather parking area.

r. Sediment control structures to collect surface runoff from the port facilities area.

s. Barge unloading beach area to receive supplies, parts, and equipment for the port facility, transportation system, mine, and housing facility.

Most of the wetland areas will be filled with gravel aggregate. Construction of surface water runoff ponds located in the wetland areas would require removal of dredge material. The sides of the sedimentation ponds will be bermed. Wetlands disturbed by the coal piles will be filled with surrounding earth material and covered with gravel aggregate where required.

Construction activities for the onshore facilities will include excavation, fill, and site preparation work to establish the designed site elevations for placement of structures and roads and to establish surface drainage. Site work will begin by clearing and grubbing of all trees and brush. This material will be pushed into windrows by crawler tractors and piled for later burning. In areas where deposits of peat and muskeg are found, drainage ditches will be constructed to drain the wet boggy areas and facilitate removal or site development. The peat material will be hauled to an approved disposal site for final placement.

Once organic surface material has been removed from the site, classified fill material will be hauled from adjacent borrow areas and placed as subgrade for building foundations. Surface drainage from the area will be established by the subgrade material providing an elevated and drained surface on which structures can be placed. Final grade would then include surface material for the onshore port facilities. Placement of grade and subgrade material will incorporate the use of scrapers, crawler tractors, water trucks, motor graders, compactors, and other equipment.

The major offshore facility would be an approximately 12,500' trestle with ship breasting and mooring dolphins. The trestle would consist of structural steel framework used to support the approach conveyor and a 5' wide roadway which will accommodate a battery powered maintenance vehicle and personnel carrier. The piers which are required to support the trestle will be spaced at approximately 400' intervals along the trestle. The piers have been designed to withstand ice, tide, seismic, and wind forces present during the year round operation. Each pier also includes cathodic protection to withstand the chemical activity of the salt water and climatic condition. This protection method helps to ensure long-term stability and operation of the pier support system. Approximately 940' of the length of the trestle would be above the mean high tide line (MHTL), thus reducing the length of the trestle extending into the inlet. The trestle would be a minimum of 20' above MHHW.

Coal would be transported from the onshore port facilities to the shiploader facility at the end of the approach trestle on a covered conveyor. Although production of 8 million tons per year requires only one 72" wide conveyor belt, sufficient room has been included in the trestle to accommodate a second 72" wide conveyor when production increases.

All coal will be loaded by use of a linear shiploader. The shiploader will be used to discharge all coal from the approach conveyor into waiting ocean-going vessels. This equipment will be constructed of steel support beams and covered where necessary to protect the equipment and coal from adverse weather. The design of the shiploader will have sufficient capacity to receive the output of two 72" wide approach conveyors. In addition, the shiploader will accommodate the tidal variations (approximately 28') and a variety of vessel sizes (22,000 to 120,000 tons DWT) along with the need for distributing the coal evenly in the ship's hatches.

A system of breasting and mooring dolphins will be used to hold the ocean-going vessel during coal loading activities to ensure the safety of the vessel and the shiploader facilities. These mooring dolphins have been specifically designed to accommodate the large tide, ice, wind, and seismic forces in the Cook Inlet.

While the vessel is moored at the shiploading area, a fendering system will be required to protect the vessel and the shiploader platform from movement of the vessel during loading activities. Vessel movement, both vertically and horizontally, will be affected by tides, wind, and ice motion in the Cook Inlet. A sliding fender will be used, supported by piers, and raised and lowered with electric wenches. The sliding fender is used to minimize effects of ice which may be encountered during winter months by always keeping the fender approximately 3' above water.

The design, fabrication, and construction of the Coal Port will take approximately three years. The construction season will last from May to October each year, shorter or longer due to weather conditions. Fabrication of modules will be completed at factory locations. The modules will be shipped by barge to the port for offloading, assembling, and erection.

The offshore facilities consist of 1) above-water equipment used to support and convey coal to a shiploader for placement into ocean-going vessels, and 2) below-water structures including piers to support the structure and withstand effects of weather, tide, and seismic activity. Construction work will begin by locating each monopile site along the trestle. Depending on the approach route selected, 18 to 30 piles will be driven with hammers to predetermined depths into the floor of the Cook Inlet for support of the approach trestle. Similar monopiles will be driven at the end of the approach trestle to support the shiploader, platform, and mooring and fendering dolphins. Once the monopiles are driven, structural steel trusses will be placed with barge-mounted cranes. The trusses serve as the platform for containment of conveyor belts and shiploading equipment. This equipment, which has been fabricated and pre-assembled, will also be placed with barge-mounted cranes. As with all structures, fabrication and pre-assembly into easily handled modules will take place at a factory location prior to shipment to the port for erection.

No site preparation work is anticipated to be necessary for either trestle and/or berthing location. Sufficient survey work has been completed to show that dredging and filling of the offshore area will not be necessary. The offshore construction activities will encompass two construction seasons. Due to adverse weather, no construction work will be planned for the winter months from November through May.

Prior to any onsite construction work, engineering, design, procurement, fabrication, and preassembly of structures into easily handled modular components will be carried out beginning in year 1 of the project. Construction work on site will be started in the spring of year 2 after ice breakup.

2. ALTERNATE PORT FACILITY (LADD COAL PORT, TIDEWATER SERVICES COMPANY, APPLICANT, 2-850260, Cook Inlet 331): Approximately 28 acres of wetlands would be filled as needed for the coal stockpile, sediment ponds and buildings.

During construction activities in years 1, 2, and 3 all materials, supplies and ewuipment would be off-loaded from barges at the Ladd Port location for transportation to other project components.

The port features and construction methods and sequences described in "1" above all applicable for the Ladd Port facility, as well.

3. TRANSPORTATION CORRIDOR GRANITE POINT (TIDEWATER SERVICES COMPANY, APPLICANT, 2-850260, Cook Inlet 331): The transportation system proposed for the project consists of the main haulage/access road and the overland conveyor system. The transportation systems would impact a total of 170 acres with approximately 45 acres of that being wetlands.

The haul road would be approximately 11.3 miles long and would generally run parallel to the conveyor system. The haul road would be built in a new right-of-way and would not use existing logging roads south of the Chuitna River. A total of approximately 2,260,000 cy of material would be placed in wetlands. The finished road surface will have two 35' wide traffic lanes with 12' wide gravel shoulders on either side, The road surface will be gravel surfaced and crowned to promote drainage from the road surface. Drainage ditches would be provided on either side of the road in level and cut areas.

All construction and operational activites related to the operation of the transportation facilities would be conducted so as to minimize potential environmental impacts. Drainage and sediment control measures would include the construction of ditches to divert runoff from undisturbed areas around operational areas, construction of collection ditches, installation of culverts under roads to collect and control runoff, surfacing of main roads and facility areas with gravel material, revegetation of road cuts, embankments and disturbed areas, and utilization of specific localized sediment control measures in sensitive areas.

Drainage and diversion structures have been designed to pass the peak discharge from a 10-year, 24 hour event.

Bridges or large culverts will be constructed to carry the road traffic at five major drainage crossings: (a) an unnamed creek north of the Chuitna River, (b) the Chuitna River, (c) an unnamed creek south of the Chuitna River, (d) Old Tyonek Creek, and (e) Tyonek Creek. During road construction, temporary pontoon bridges or stream fords will be used to provide equipment access. Permanent bridge structures will be of truss and girder construction supported by concrete lower case piers.

There are several locations along the alignment of the haul road where the presence of peat or muskeg deposits in combination with saturated or semi-saturated glacial outwash and alluvium result in adverse surface conditions for road construction. In these areas, a special construction technique will be used which incorporates the following fill sequence: The natural vegetative mat; a flotation material typically of wood chips or logs; a minimally compacted layer of fill material; geotechnical fabric to provide lateral stability, drainage and distribute bearing loads over a large area; and, finally normal road construction techniques.

The overland conveyor system would run roughly parallel to the haul road for a length of 9.8 miles. A light duty, minimally improved service/access road suitable for four-wheel drive vehicles would be built immediately adjacent to the conveyor for maintenance purposes. The right-of way would be cleared for a width of approximately 25'. A total of approximately 225,000 cy of material would be placed in wetlands.

Drainage and sediment control measures for the conveyor would be the same as those described for the main haul road. Brush within the conveyor right-of-way would be mechanically controlled; no herbicides would be used.

Limited cut and fill work would be required along the alignment of the overland conveyor system and the adjacent access road. Generally both conveyor alignments have been selected to avoid major topographic features. Construction would be similar to the haul road construction described previously.

Conveyor support bridges would be constructed at the same five drainages briuged by the haul road. The conveyor crossing of the Chuitna River would require an extended span supported by a cable suspension structure. In most areas along the conveyor right-of-way the support piers of the conveyor would be anchored to poured concrete footings; however, in those areas where unstable surface materials will not provide adequate lateral support, pilings, spread footings, or a combination of the two would be utilized in the foundation structures.

At ten points, the conveyor would be buried for a minimum of 200' in large diameter culverts or arch spans to permit moose, bear and other animals to pass over the conveyor. There would also be three places where the conveyor would be raised to permit existing roads to pass underneath.

During construction of the overland conveyor system, both temporary and permanent diversion systems would be constructed to divert runoff through culverts installed under the access road.

In certain sensitive areas such as construction areas adjacent to stream channels, localized sediment control measures similar to those such disturbed areas would be revegetated and mulched, if necessary, as soon after completion of construction activities as possible to minimize surface erosion.

4. TRANSPORTATION CORRIDOR-LADD (TIDEWATER SERVICES COMPANY, APPLICANT, 2-850260, Cook Inlet 331): The haul road for this alternate site would be approximately 13 miles long. Approximately 69 acres of wetlands would be filled. The construction methods and sequences described in "3" above are applicable for this corridor, as well.

5. HOUSING FACILITIES (TIDEWATER SERVICES COMPANY, APPLICANT, 2-850260, Cook Inlet 331): Because of the remoteness of the project site from Anchorage and other Alaska communities, the applicants are planning the construction of a housing complex to accommodate the work force of 500 employees. A landing strip located approximately one mile north of the housing area is also proposed to allow shuttling of employees between Anchorage and the site. The housing complex including roads and landing strip would impact approximately 72 acres with 6 acres being in wetlands. A total of approximately 60,000 cy of fill would be placed in wetlands.

The housing complex would include: housing buildings, arctic corridors, dining building, recreation building and facilities, access roads, parking, boiler plant, maintenance/warehouse facilities, sewer plant, and water treatment plant. The landing strip and associated facilities include a landing strip, terminal building and a maintenance building. A north-south and east-west runway would be constructed. A total of approximately 90,000 cy of fill would be placed in wetlands for the landing strip.

Access to the housing complex would be provided by a one-half mile road from the main haul road. Another road approximately one-quarter mile in length would connect the main haul road to the landing strip. Another short road would be constructed from the housing area north to the sewage treatment plant.

The roads would be all weather roads suitable for bus traffic and light vehicle use. Sufficient parking would be provided. In order to control dust, access roads would be watered on a periodic basis.

During construction of the housing facilities, a series of diversion ditches and a sediment pond would be constructed. These ditches and ponds would serve to control runoff from the site and retain sediment. In order to control wildlife in the area, protection measures would be taken with trash and garbage in the area. Trash and garbage would be incinerated or disposed of in dumpsters. The dumpsters would be enclosed to prevent wildlife access.

The sites would be landscaped with grasses, shrubs, and trees native to this part of Alaska. The landscaping would serve to minimize erosion and sediment while being aesthetically pleasing.

6. MINE FACILITY (DIAMOND ALASKA COAL COMPANY, APPLICANT, 2-850261, Cook Inlet 332): The mine unit is approximately 10,000 acres although the actual area to be mined would be 5240 acres in size. This area would be divided into north and south pits which would be mined simultaneously but in separate operations during the life of the project. A maximum of 450 acres of pit would be open at any one time. An additional maximum of 150 acres around the pit would be disturbed at any one time in clearing and grubbing the vegetation in preparation for stripping overburden, or recontouring in preparation for revegetation. Average pit depth would be approximately 200 feet.

The mine area would disturb approximately 1086 acres of wetlands, while sediment ponds, haul roads, facilities, and overburden stockpiles would disturb an additional approximately 8 acres of wetlands.

A system of sediment ponds and collection ditches would be constructed to ensure that discharges from drainage alterations and runoff into the pit meet applicable water quality standards. Where other treatment was necessary before discharge, e.g. flocculation, additional treatment facilities would be built in conjunction with the sediment ponds.

At the start of operations, 22 million cubic yards of overburden from the initial cut would be excavated and placed in a permanent stockpile. This stockpile would be stabilized, graded and then revegetated to prevent erosion.

The permanent mine service area would be located on the southern edge of the mining limit. This area would include the main administration building; a service building housing the maintenance, warehouse and service facilities; equipment ready lines; water, diesel fuel, gasoline and lubricant storage; electrical substation; ambulance and fire station; water and sewage treatment plants; emergency power system; explosives magazine; heliport; and emergency and safety facilities. The coal would be crushed in the mine servcie area and loaded to the conveyor for transport to the port. The coal would not be washed or otherwise processed.

WATER QUALITY CERTIFICATION: A permit for the described work will not be issued until a certification or waiver of certification as required under Section 401 of the Clean Water Act (Public Law 95-217), has been received from the Alaska Department of Environmental Conservation.

COASTAL ZONE MANAGEMENT ACT CERTIFICATE: Section 307(c)(3) of the Coastal Zone Management Act of 1972, as amended by 16 U.S.C. 1456(c)(3), requires the applicant to certify that the described activity affecting land or water uses in the Coastal Zone complies with the Alaska Coastal Management Program. A permit will not be issued until the Office of Management and Budget, Division of Governmental Coordination has concurred with the applicant's certification.

PUBLIC HEARING: Public Hearings will be held as follows:

August 17, 1988
7 pm to 10 pm, Conference Room
Federal Building, 701 C Street
Anchorage, Alaska

August 18, 1988
7 pm to 10 pm
Tyonek Community Center
Tyonek, Alaska

CULTURAL RESOURCES: A cultural resources study has been done in the area. If has been determined and coordinated with the State Historic Preservation Officer that there would be no effect on cultural resources.

ENDANGERED SPECIES: The project area is within the known or historic range of the Peregrine Falcon. However no nest sites have been located and no impact is expected to occur.

FEDERAL SPECIES OF CONCERN: The following National Species of Special Emphasis were recorded within or adjacent to the project area: Chinook Salmon, Coho Salmon, Steelhead Trout, Canada Goose, Snow Goose, Trumpeter Swan, Mallard, Sandhill Crane and Bald Eagle.

The following additional species of Special Emphasis are found in the region of the project area: Brant, White-fronted Goose, Canvasback, and Peregrine Falcon.

FLOOD PLAIN MANAGEMENT: Evaluation of the described activity will include conformance with appropriate State or local flood plain standards; consideration of alternative sites and methods of accomplishment; and weighing of the positive, concentrated and dispersed, and short and long-term impacts on the flood plain.

SPECIAL AREA DESIGNATION: None.

EVUALATION: The decision whether to issue a permit will be based on an evaluation of the probable impacts including cumulative impacts of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts which the proposed activity may have on the public interest requires a careful weighing of all those factors which become relevant in each particular case. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonable foreseeable detriments. The decision whether to authorize a proposal, and if so the conditions under which it will be allowed to occur, are therefore determined by the outcome of the general balancing process. That decision should reflect the national concern for both protection and utilization of important resources. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof. Among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people.

For activities involving 404 discharges, a permit will be denied if the discharge that would be authorized by such permit would not comply with the Environmental Protection Agency's 404(b)(1) guidelines. Subject to the preceding sentence and any other applicable guidelines or criteria (see Sections 320.2 and 320.3), a permit will be granted unless the District Engineer determines that it would be contrary to the public interest.

AUTHORITY: This permit will be issued or denied under the following authorities:

(X) Perform work in or affecting navigable waters of the United States - Section 10, Rivers and Harbors Act 1899 (33 U.S.C. 403).

(X) Discharge dredged or fill material into waters of the United States - Section 404, Clean Water Act (33 U.S.C. 1344). Therefore, our public interest review will consider the guidelines set forth under Section 404(b) of the Clean Water Act (40 CFR 230).

Comments on the described work, with the reference number, should reach this office no later than the expiration date of this Public Notice to become part of the record and be considered in the decision. If further information is desired concerning this notice, contact Ms. Carol Gorbics at (907) 753-2724.

A plan, Notice of Application for Certification of Consistency with the Alaska Coastal Management Program, and Notice of Application for State Water Quality Certification are attached to this Public Notice

District Engineer
U.S. Army, Corps of Engineers

Attachments

If you would like a copy of the Environmental Impact Statement, please fill this out and return to the address listed below.

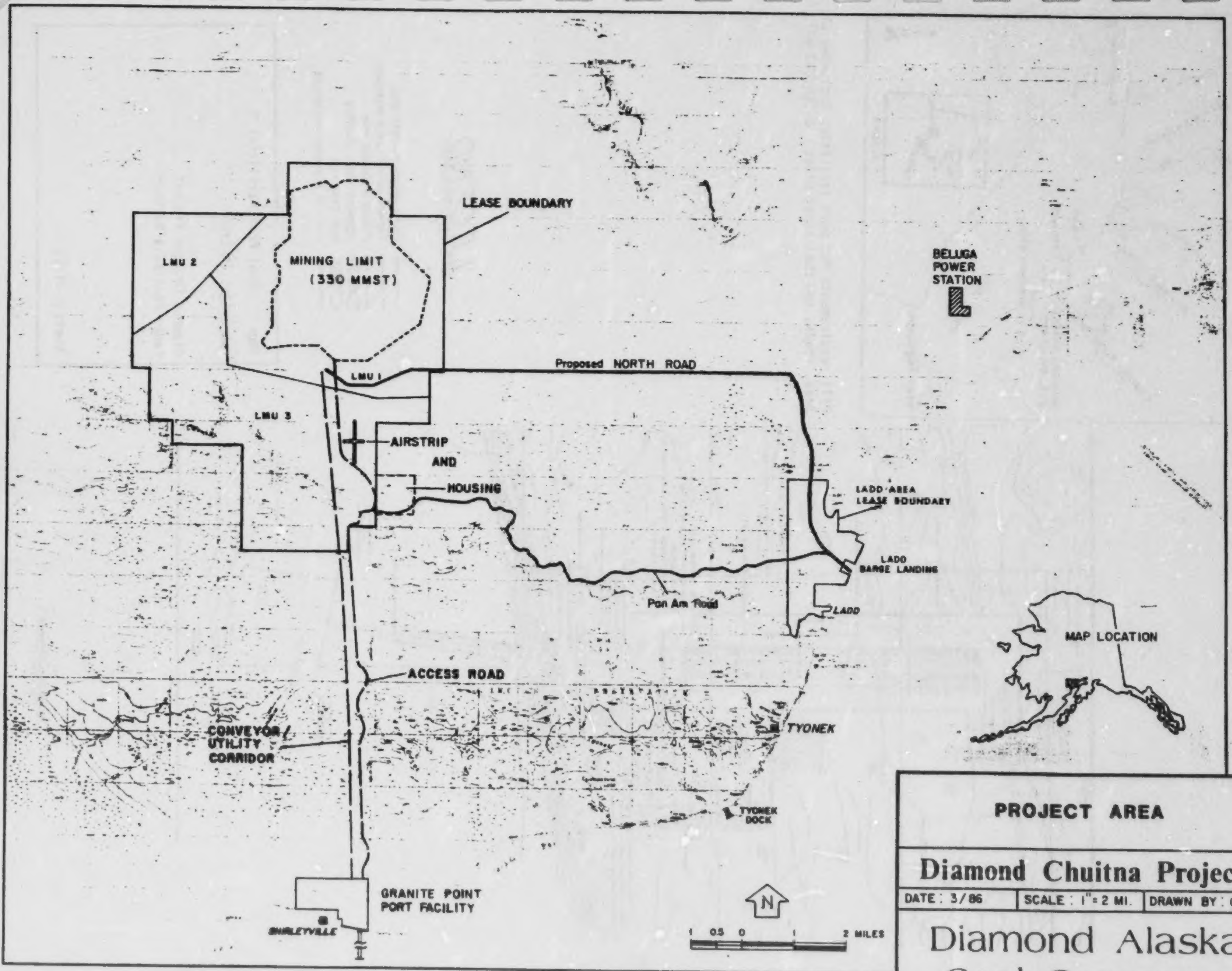
NAME: ____

MAILING ADDRESS: ____

__________ I would like a copy of the Draft EIS for the Diamond AK Coal Project

__________ I would like a copy of the Final EIS for the Diamond AK Coal Project

SEND to: Mr. Rick Seaborne
U.S. Environmental Protection Agency - EEB
1200 Sixth Avenue, WD 136
Seattle, Washington 98101

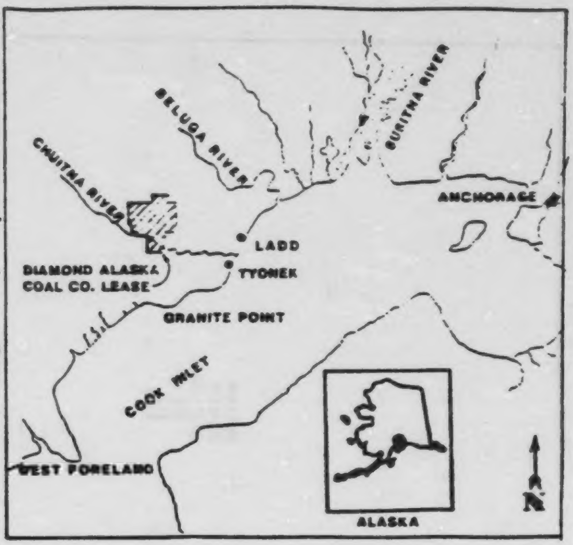

LEASE BOUNDARY
LMU 2
MINING LIMIT (330 MMST)
LMU 1
LMU 3
Proposed NORTH ROAD
AIRSTRIP AND HOUSING
BELUGA POWER STATION
LADD AREA LEASE BOUNDARY
LADD BARGE LANDING
LADD
Pan Am Road
ACCESS ROAD
CONVEYOR/ UTILITY CORRIDOR
TYONEK
TYONEK DOCK
MAP LOCATION
GRANITE POINT PORT FACILITY
SHIRLEYVILLE
N
1 0.5 0 1 2 MILES

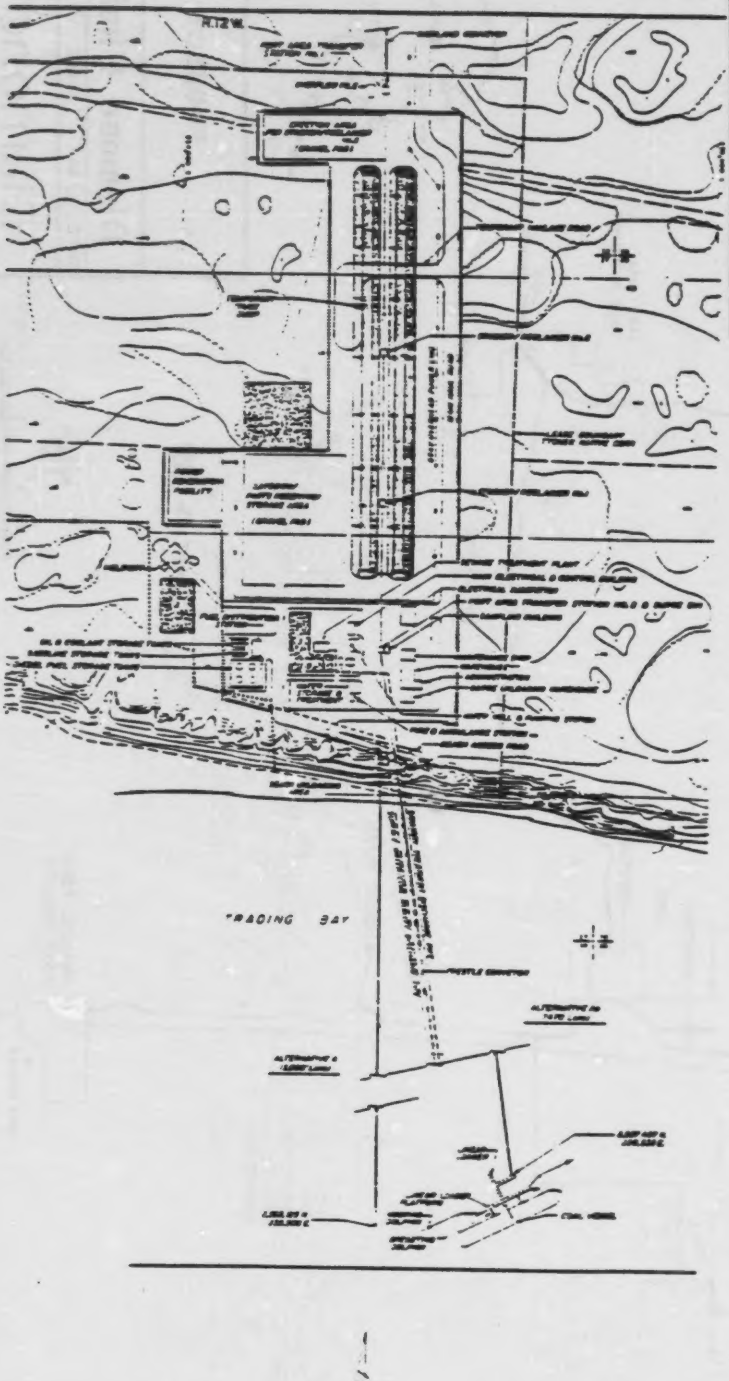
PROJECT AREA

Diamond Chuitna Project

DATE : 3/86 | SCALE : 1" = 2 MI. | DRAWN BY : C.G.I.

Diamond Alaska
Coal Company


BELUGA RIVER
SUSITNA RIVER
CHUITNA RIVER
ANCHORAGE
LADD
TYONEK
DIAMOND ALASKA COAL CO. LEASE
GRANITE POINT
COOK INLET
WEST FORELAND
ALASKA
N


R.12 W.
TRADING BAY

Fill requirements for port facilities including all pads, roads, and coal stock piles - 3,360,000 yd^3

LEGEND

┈┈┈ LEASE BOUNDARY—PORT AREA
– – – TYONEK NATIVE LANDS BOUNDARY
— — — SEWAGE DISCHARGE PIPE
▨ SEDIMENT POND LOCATION
▭ COAL STOCKPILE
—— LIMIT OF ELEVATED AGGREGATE

Map Coal Port Facilities –
Granite Point

Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 2 of 15

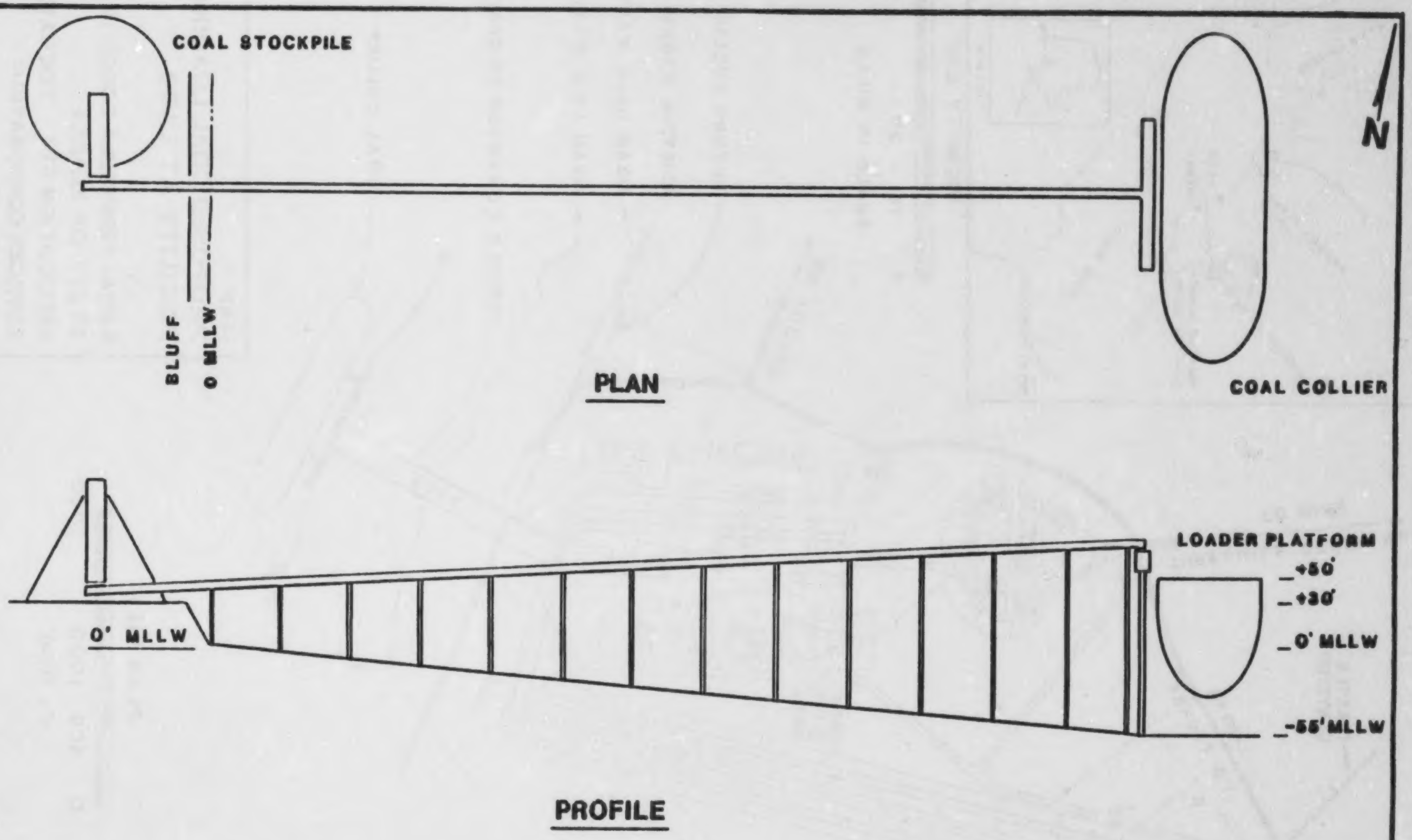
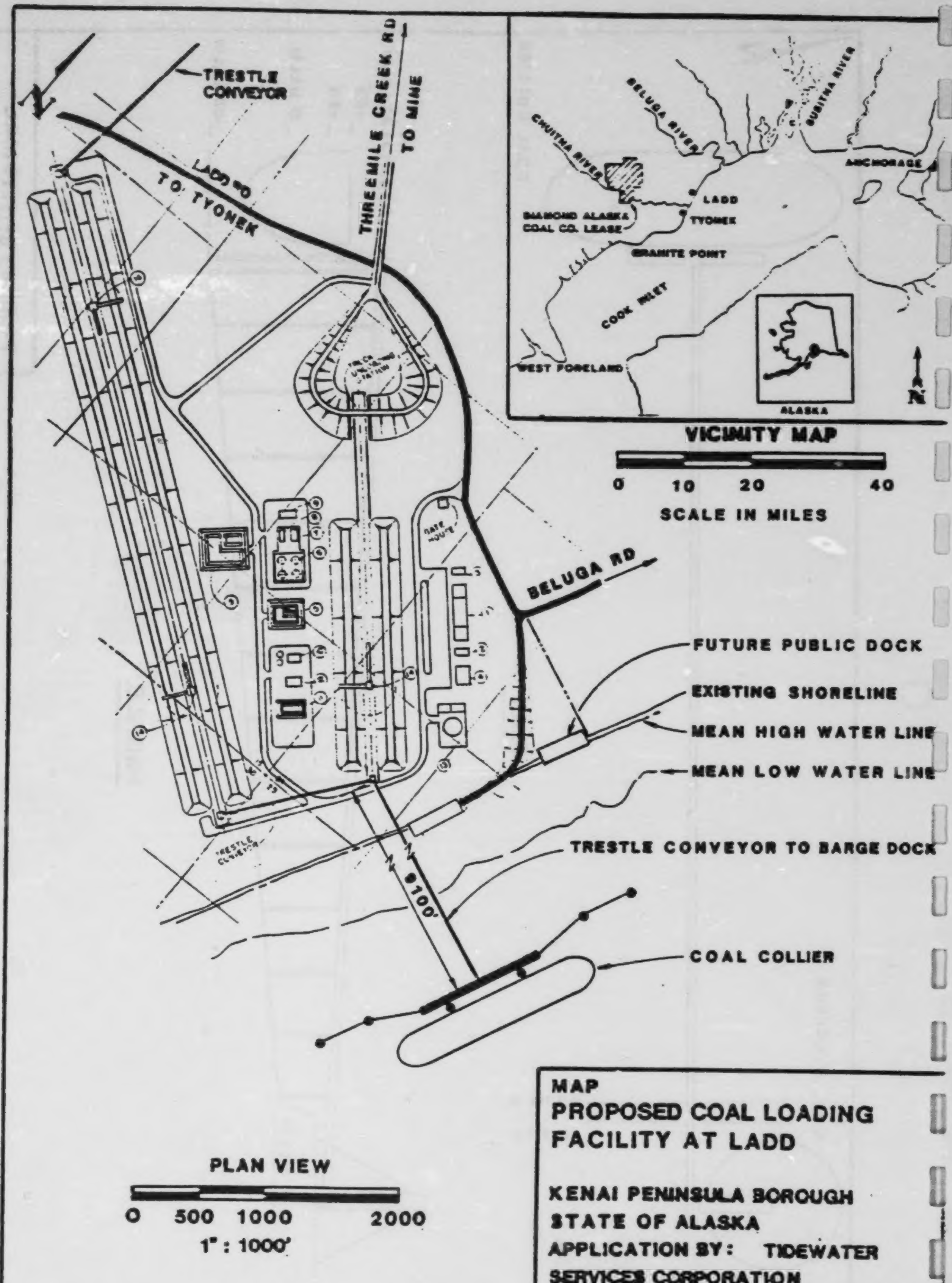

COAL STOCKPILE
BLUFF
0 MLLW
N
PLAN
COAL COLLIER
O' MLLW
LOADER PLATFORM
+50'
+30'
0' MLLW
-55' MLLW
PROFILE

FIGURE 3 of 15 TYPICAL
LOADING STRUCTURE
LADD LOADING AREA
5/87 NTS

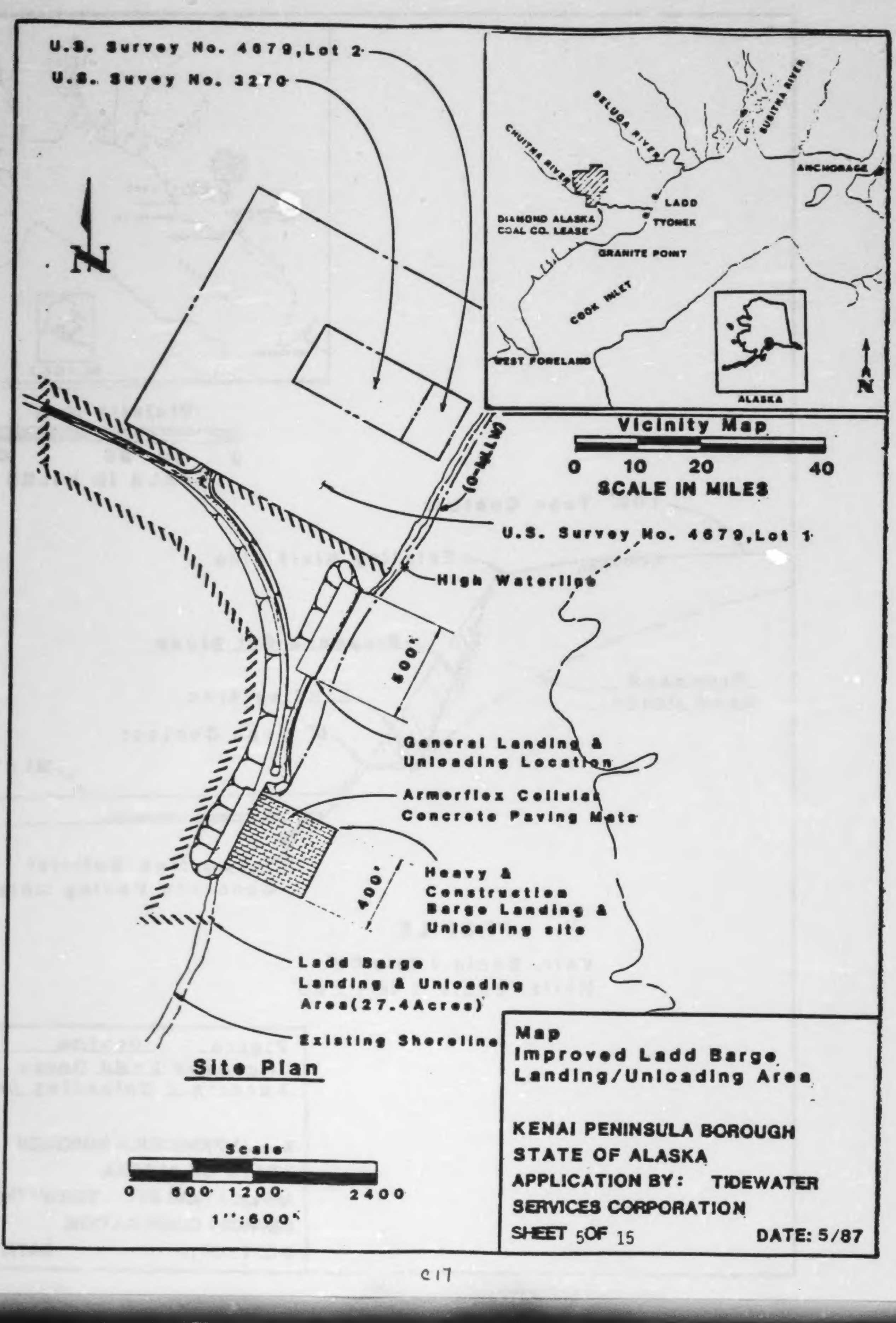

TRESTLE CONVEYOR
THREEMILE CREEK RD
TO MINE
LADD RD
TO TYONEK
GATE HOUSE
BELUGA RD
FUTURE PUBLIC DOCK
EXISTING SHORELINE
MEAN HIGH WATER LINE
MEAN LOW WATER LINE
TRESTLE CONVEYOR
TRESTLE CONVEYOR TO BARGE DOCK
8100'
COAL COLLIER
BELUGA RIVER
CHUITNA RIVER
SUSITNA RIVER
ANCHORAGE
LADD
TYONEK
DIAMOND ALASKA COAL CO. LEASE
GRANITE POINT
COOK INLET
WEST FORELAND
ALASKA
N
VICINITY MAP
0 10 20 40
SCALE IN MILES
PLAN VIEW
0 500 1000 2000
1" : 1000'

MAP

PROPOSED COAL LOADING FACILITY AT LADD

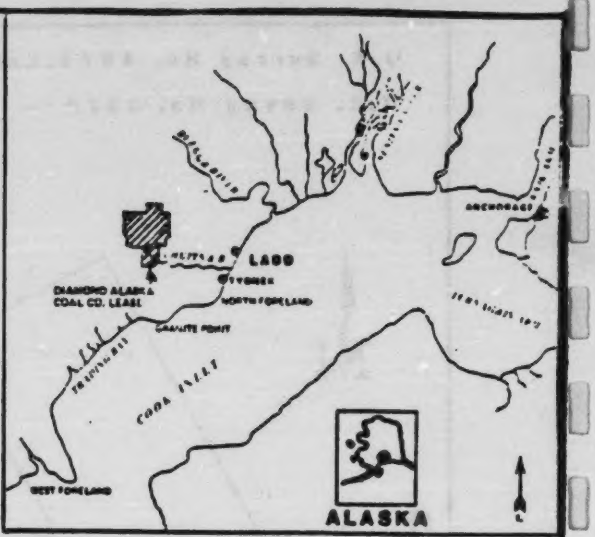
KENAI PENINSULA BOROUGH
STATE OF ALASKA
APPLICATION BY: TIDEWATER SERVICES CORPORATION
SHEET 1 OF 15 DATE: 5/87

C16


U.S. Survey No. 4679,Lot 2
U.S. Suvey No. 3270
N
(0-MLLW)
U.S. Survey No. 4679,Lot 1
High Waterline
500'
General Landing & Unloading Location
Armorflex Cellular Concrete Paving Mats
400'
Heavy & Construction Barge Landing & Unloading site
Ladd Barge Landing & Unloading Area(27.4Acres)
Existing Shoreline
Site Plan
Scale
0
600
1200
2400
1'':600'
BELUGA RIVER
SUSITNA RIVER
CHUITNA RIVER
ANCHORAGE
LADD
TYONEK
DIAMOND ALASKA COAL CO. LEASE
GRANITE POINT
COOK INLET
WEST FORELAND
ALASKA
N
Vicinity Map
0
10
20
40
SCALE IN MILES

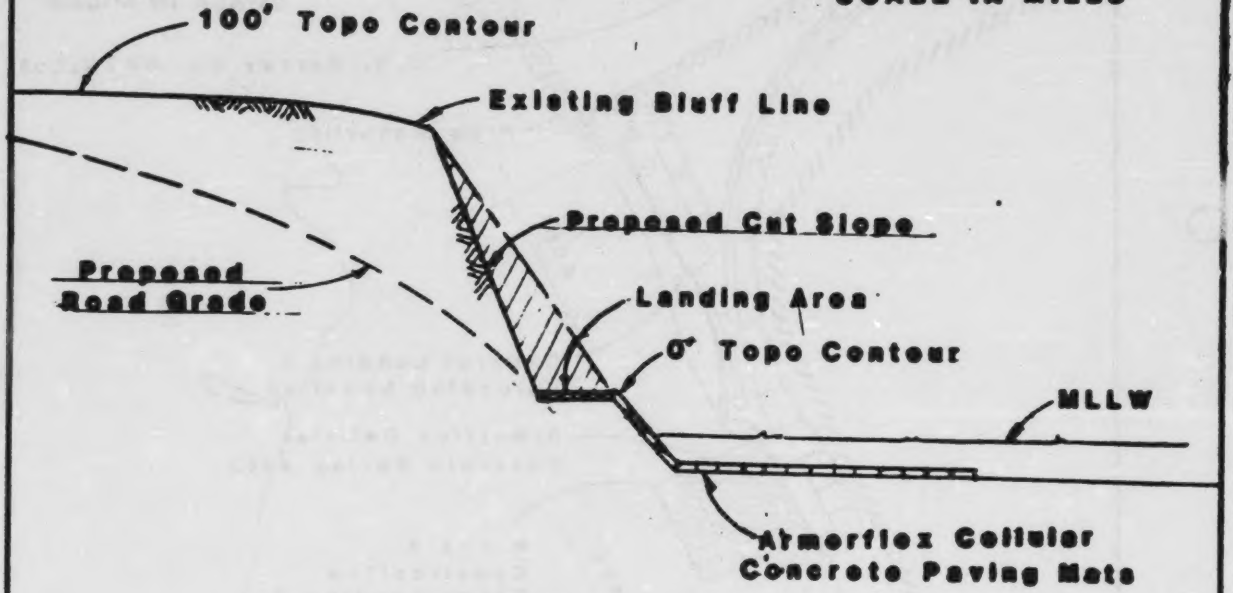
Map
Improved Ladd Barge Landing/Unloading Area

KENAI PENINSULA BOROUGH
STATE OF ALASKA
APPLICATION BY: TIDEWATER SERVICES CORPORATION
SHEET 5 OF 15 DATE: 5/87


LADD
TYONEK
DIAMOND ALASKA COAL CO. LEASE
NORTH FORELAND
GRANITE POINT
COOK INLET
WEST FORELAND
ANCHORAGE
ALASKA

Vicinity Map

0 10 20 40
SCALE IN MILES

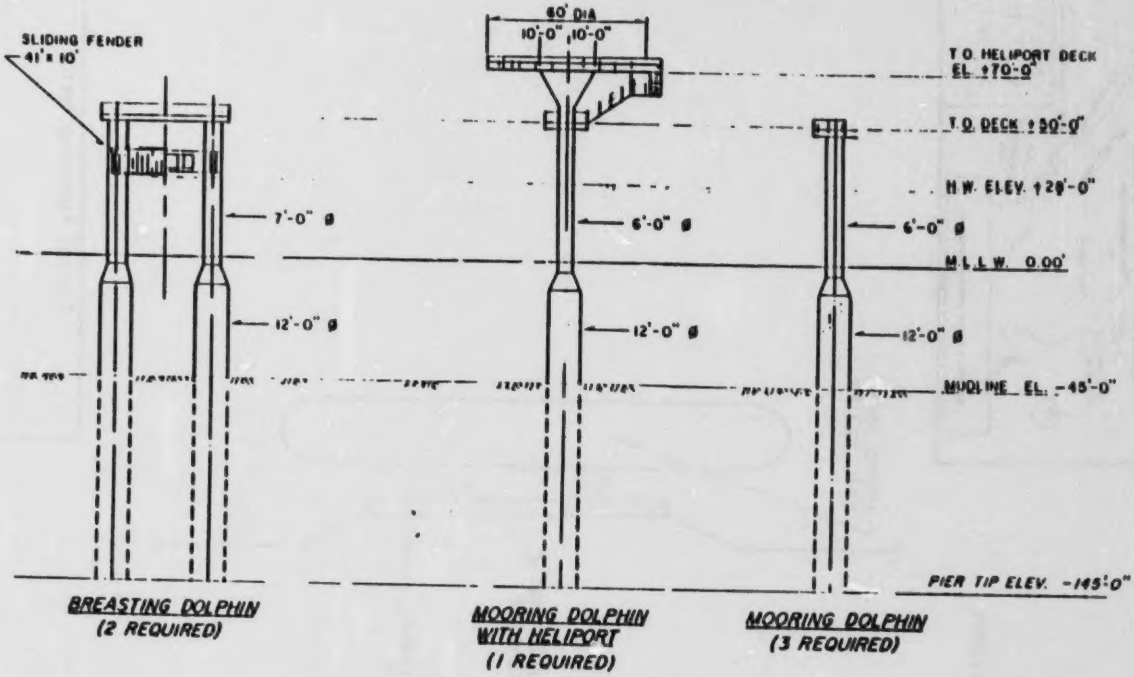

100' Topo Contour
Existing Bluff Line
Proposed Cut Slope
Proposed Road Grade
Landing Area
0' Topo Contour
MLLW
Armorflex Cellular Concrete Paving Mats

PROFILE

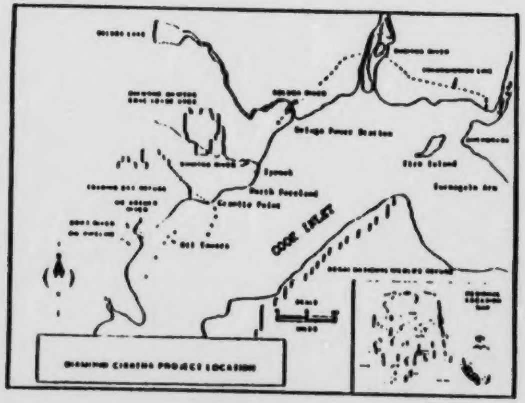
Vert. Scale 1 in : 60'
Horiz. Scale 1 in : 200'

Figure Profile
Improved Ladd Barge
Landing / Unloading Area

KENAI PENINSULA BOROUGH
STATE OF ALASKA
APPLICATION BY: TIDEWATER
SERVICES CORPORATION
SHEET 6 OF 15 DATE: 3/87


SLIDING FENDER
41' x 10'
7'-0" ø
12'-0" ø
BREASTING DOLPHIN
(2 REQUIRED)
60' DIA
10'-0"
10'-0"
6'-0" ø
12'-0" ø
MOORING DOLPHIN
WITH HELIPORT
(1 REQUIRED)
6'-0" ø
12'-0" ø
MOORING DOLPHIN
(3 REQUIRED)
T.O. HELIPORT DECK
EL. +70'-0"
T.O. DECK +50'-0"
H.W. ELEV. +20'-0"
M.L.L.W. 0.00'
MUDLINE EL. -45'-0"
PIER TIP ELEV. -145'-0"

C19

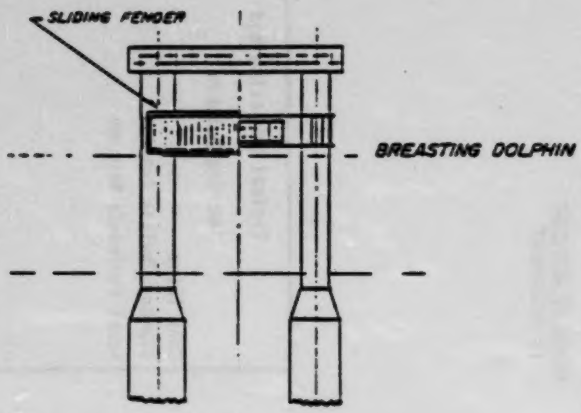

Beluga Power Station
Tyonek
North Foreland
Granite Point
Oil Towers
Fire Island
Turnagain Arm
COOK INLET
DIAMOND CHUITNA PROJECT LOCATION

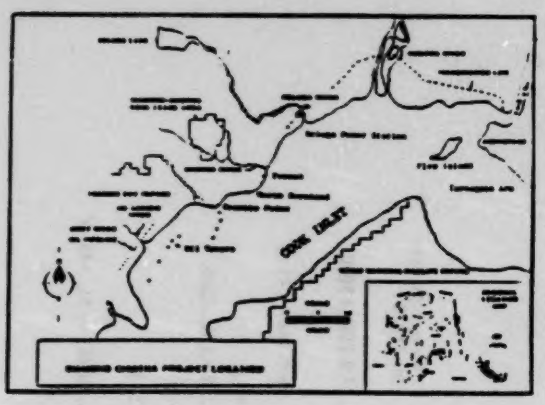
Typical Breasting and

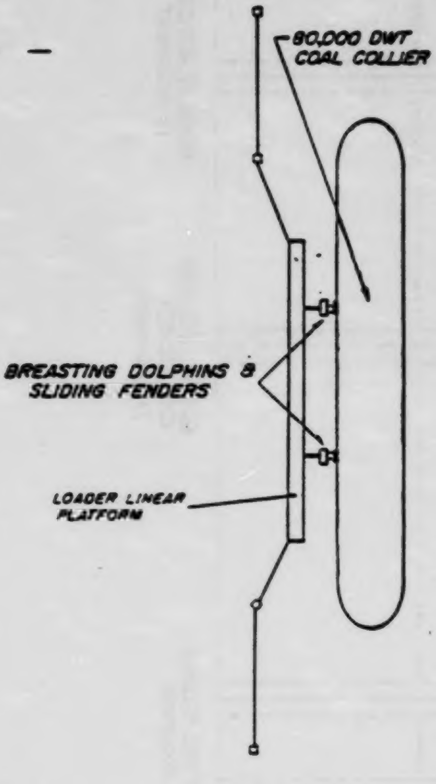
Mooring Dolphin

Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 7 of 15


SLIDING FENDER
BREASTING DOLPHIN

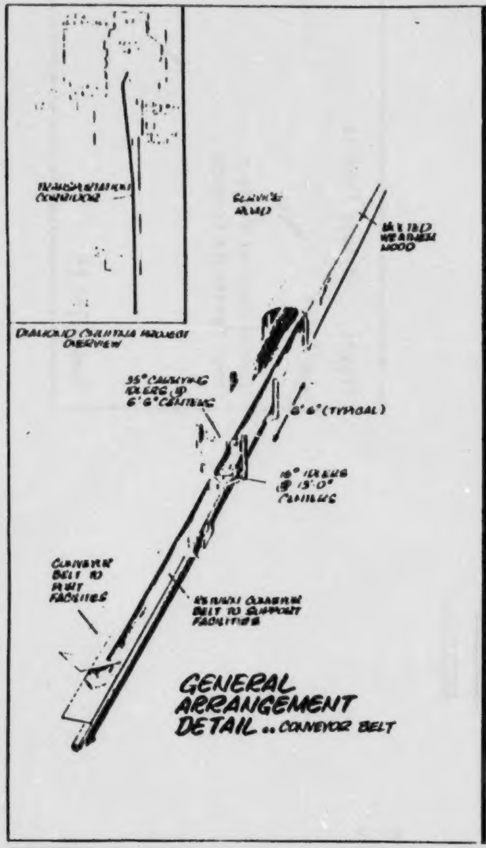



80,000 DWT
COAL COLLIER
BREASTING DOLPHINS &
SLIDING FENDERS
LOADER LINEAR
PLATFORM

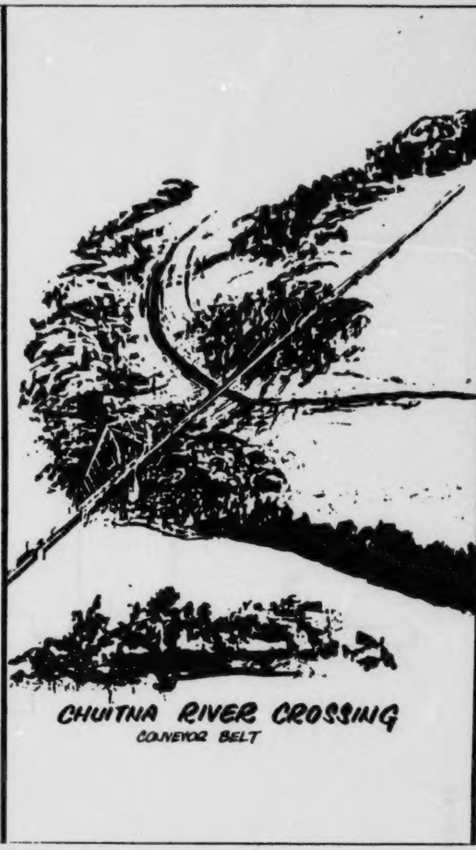
Typical Fendering System

Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

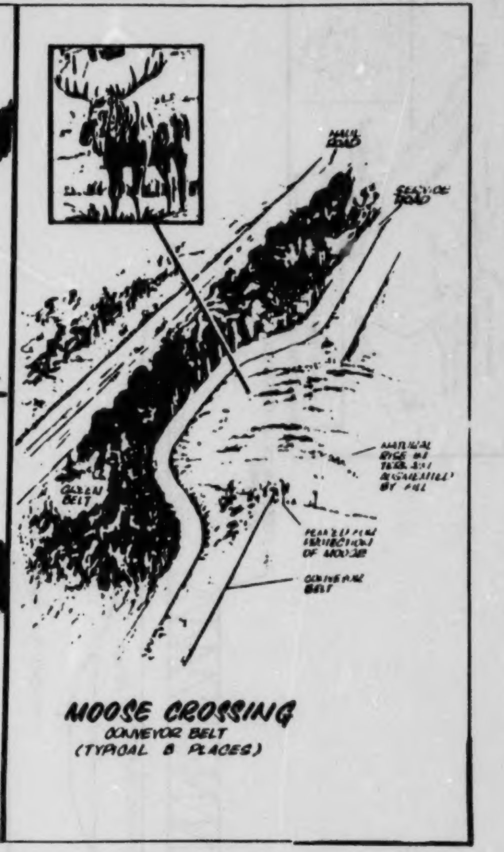
Sheet 8 of 15


TRANSPORTATION CORRIDOR
DIAMOND CHUITNA PROJECT OVERVIEW
SERVICE ROAD
BELTED WEATHER HOOD
35° CARRYING IDLERS @ 6'6" CENTERS
6'6" (TYPICAL)
10° IDLERS @ 13'0" CENTERS
CONVEYOR BELT TO PORT FACILITIES
RETURN CONVEYOR BELT TO SUPPORT FACILITIES

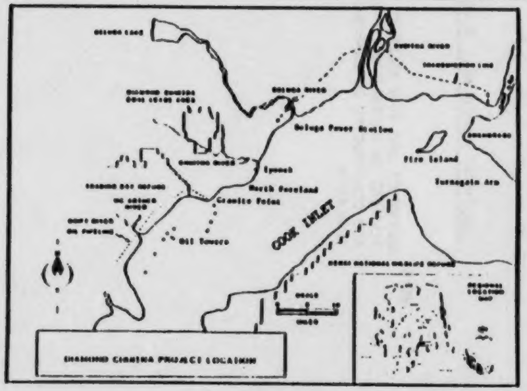
GENERAL ARRANGEMENT DETAIL .. CONVEYOR BELT



CHUITNA RIVER CROSSING
CONVEYOR BELT

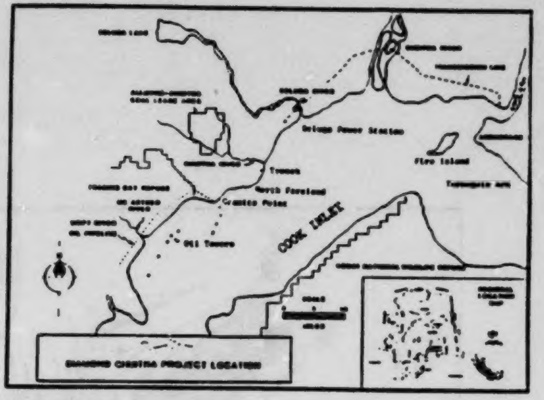

HAUL ROAD
SERVICE ROAD
GREEN BELT
PREFERRED DIRECTION OF MOOSE
CONVEYOR BELT

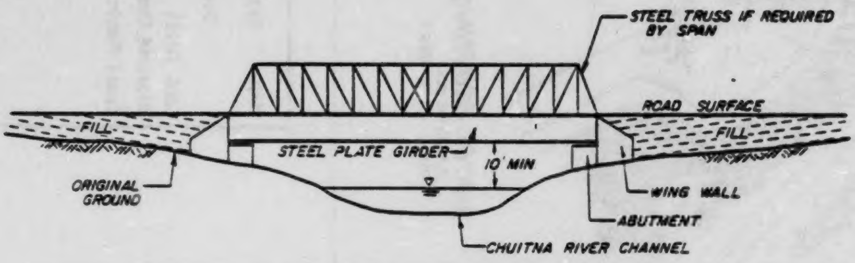
MOOSE CROSSING
CONVEYOR BELT
(TYPICAL 8 PLACES)

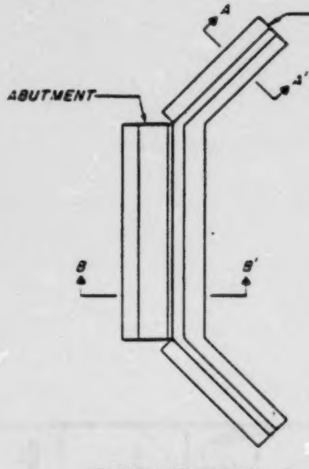

Beluga Power Station
Fire Island
Tyonek
North Foreland
Granite Point
Oil Towers
Turnagain Arm
COOK INLET
DIAMOND CHUITNA PROJECT LOCATION

Map ' Artist Illustration -
Overland Conveyor
Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

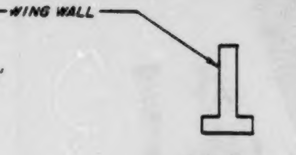
Sheet 9 of 15


Beluga Power Station
Tyonek
North Foreland
Granite Point
Oil Towers
COOK INLET
Fire Island

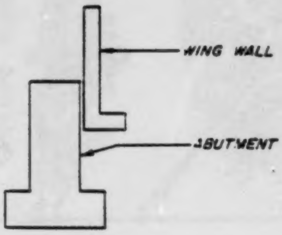

STEEL TRUSS IF REQUIRED BY SPAN
ROAD SURFACE
FILL
FILL
STEEL PLATE GIRDER
10' MIN
ORIGINAL GROUND
WING WALL
ABUTMENT
CHUITNA RIVER CHANNEL


A
A'
ABUTMENT
B
B'

ABUTMENT & WING WALL PLAN



SECTION A-A'


WING WALL
ABUTMENT

SECTION B-B'

NOTE

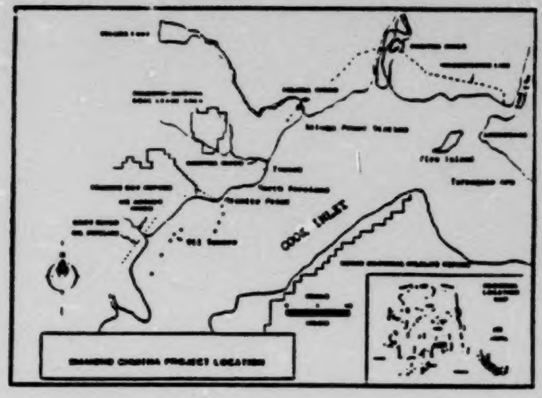
ABUTMENTS AND WING WALLS TO BE FOUNDED ON SUITABLE MATERIAL AND CONSTRUCTED OF REINFORCED CONCRETE

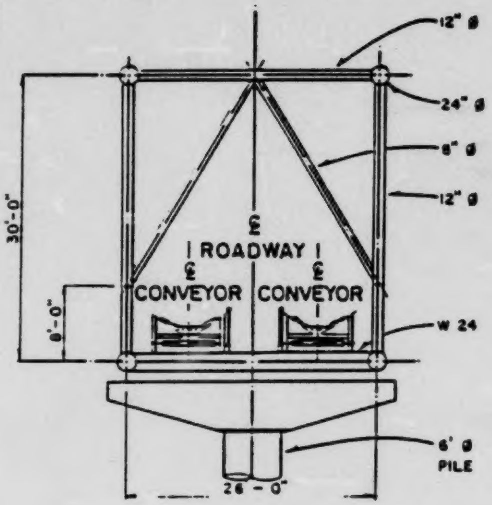
Figure - Bridge Profile

Cook Inlet

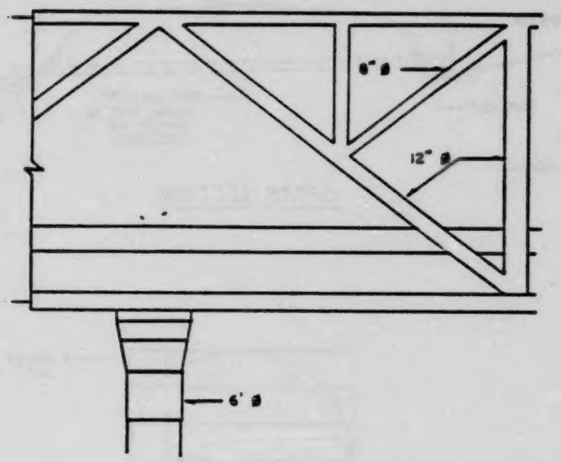
Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 10 of 15


COOK INLET
DIAMOND CHUITNA PROJECT LOCATION


12" ø
24" ø
8" ø
12" ø
30'-0"
℄ ROADWAY
℄ CONVEYOR
℄ CONVEYOR
8'-0"
W 24
6' ø PILE
26'-0"

FRONT VIEW

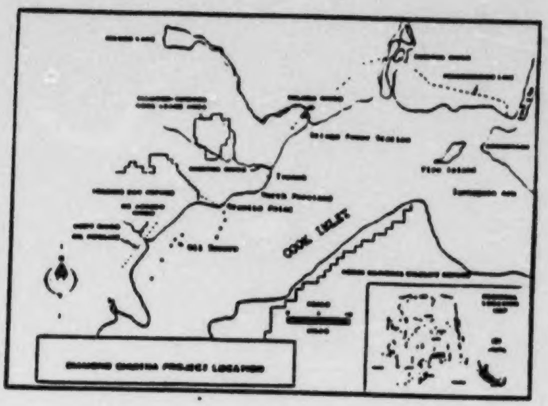


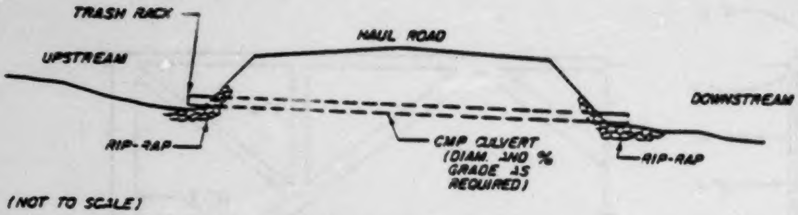
RIGHT VIEW

Trestle and Pier

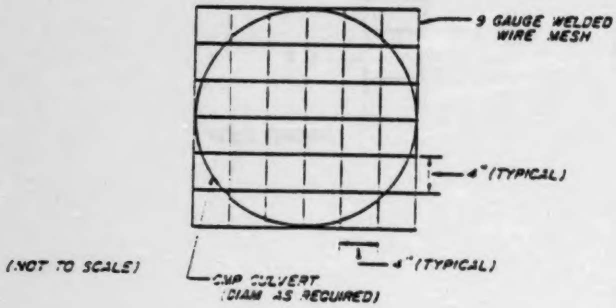
Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 11 of 15




TRASH RACK
HAUL ROAD
UPSTREAM
DOWNSTREAM
RIP-RAP
CMP CULVERT (DIAM. AND % GRADE AS REQUIRED)
RIP-RAP
(NOT TO SCALE)

CROSS SECTION


9 GAUGE WELDED WIRE MESH
4" (TYPICAL)
(NOT TO SCALE)
CMP CULVERT (DIAM AS REQUIRED)
4" (TYPICAL)

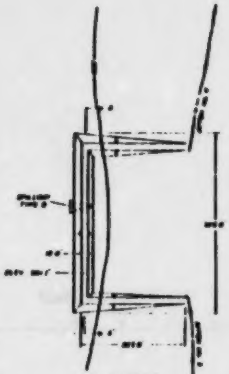
TRASH RACK DETAIL

Culvert Installation

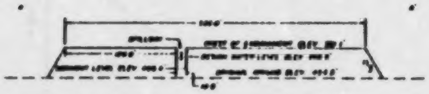
Cook Inlet

Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 12 of 15

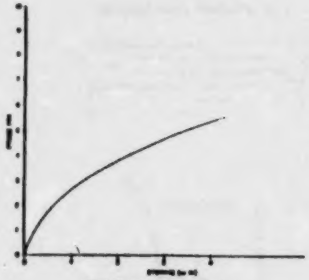


PLAN VIEW

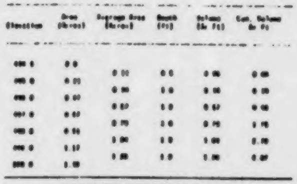


EMBANKMENT PROFILE A-A'

C25

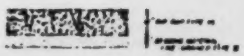


STAGE STORAGE CURVE

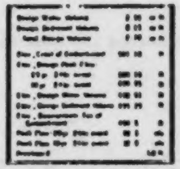


STORAGE CAPACITY TABLE

TYPICAL PRINCIPAL/EMERGENCY SPILLWAY DETAILS

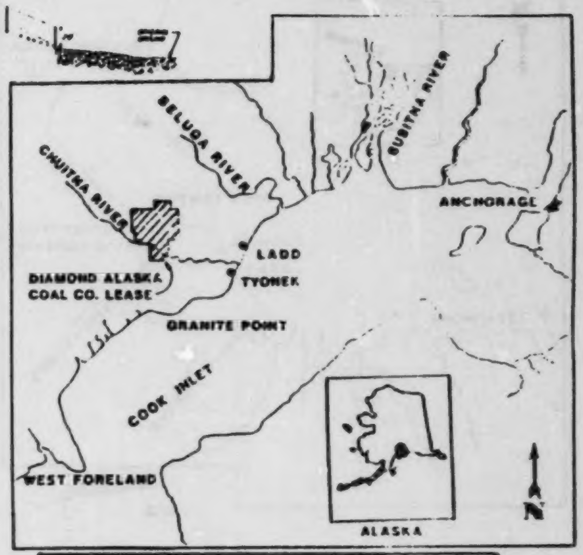


TYPICAL RIP-RAP/BEDDING MATERIAL



DESIGN CRITERIA

NOTE: FOR POND LOCATION, SEE "DRAINAGE AND SEDIMENT CONTROL PLAN"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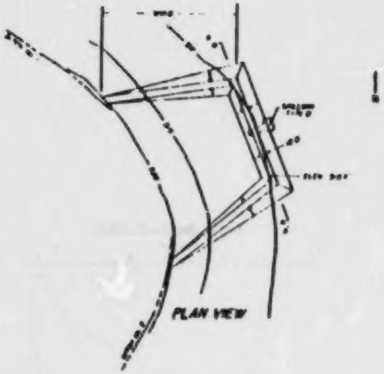
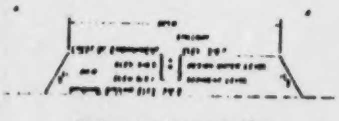
BELUGA RIVER
ANCHORAGE
CHUITNA RIVER
LADD
TYONEK
DIAMOND ALASKA COAL CO. LEASE
GRANITE POINT
COOK INLET
WEST FORELAND
ALASKA
N

Map Sediment Pond No. 1

Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 13 of 15


PLAN VIEW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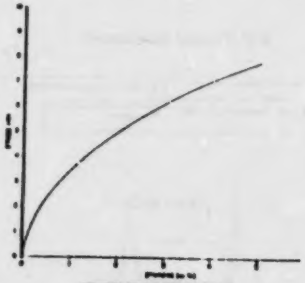
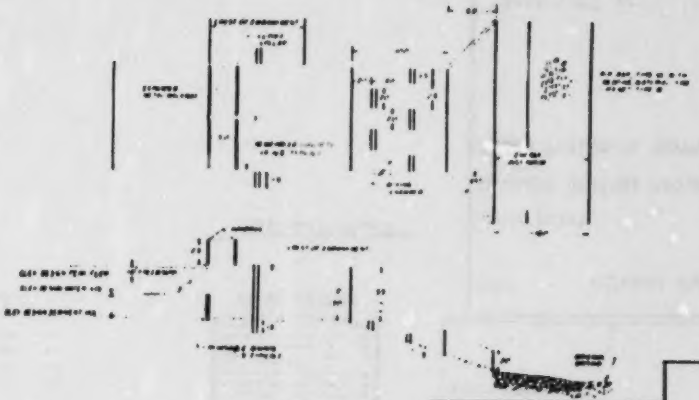
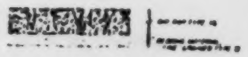

STAGE STORAGE CURVE

c26


TYPICAL PRINCIPAL/EMERGENCY SPILLWAY DETAILS


TYPICAL RIP-RAP/BEDDING MATERIAL

Elevation	Area (Acres)	Average Area (Acres)	Depth (Ft)	Volume (Ac-Ft)	Cum. Volume Ac-Ft
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[illegible]	[illegible]				
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STORAGE CAPACITY TABLE

[illegible]	[illegible]	[illegible]
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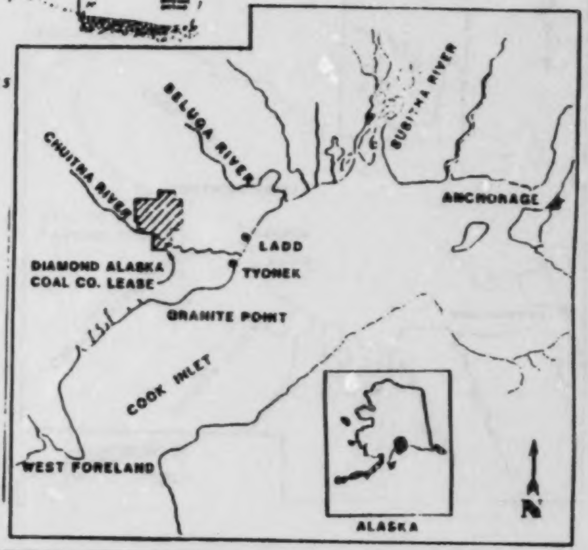
DESIGN CRITERIA

NOTE: FOR POND LOCATIONS, SEE "DRAINAGE AND SEDIMENT CONTROL PLAN"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BELUGA RIVER
CHUITNA RIVER
ANCHORAGE
LADD
TYONEK
DIAMOND ALASKA
COAL CO. LEASE
GRANITE POINT
COOK INLET
WEST FORELAND
ALASKA
N

Map Sediment Pond No. 2

Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

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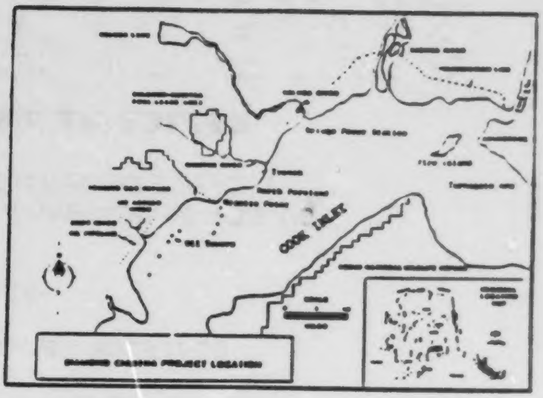

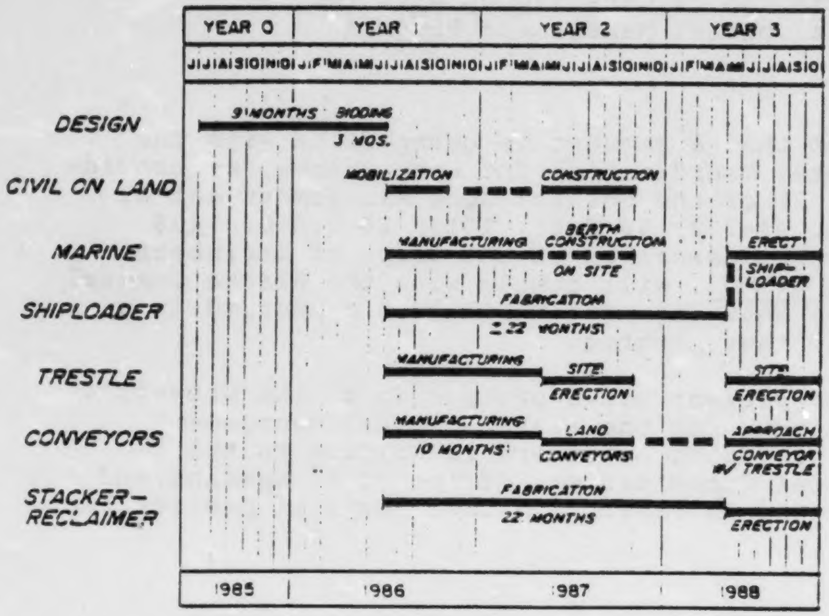

Construction Schedule

Cook Inlet
Diamond Chuitna Project
Kenai Peninsula Borough

Sheet 15 of 15

STATE OF ALASKA

OFFICE OF THE GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET
DIVISION OF GOVERNMENTAL COORDINATION

STEVE COWPER, GOVERNOR

CENTRAL OFFICE
P.O. BOX AW
JUNEAU, ALASKA 99811-0165
PHONE (907) 465-3562

STATE OF ALASKA

DIVISION OF GOVERNMENTAL COORDINATION

Notice of Application for Certification of Consistency with the Alaska Coastal Management Program

Notice is hereby given that a request is being filed with the Division of Governmental Coordination for concurrence, as provided in Section 307 (c)(3) of the Coastal Zone Management Act of 1972, as amended [P.L. 94-370; 90 Stat. 1013; 16 U.S.C. 1456 (c)(3)], that the project described in the Corps of Engineers Public Notice No. (See Below), will comply with the Alaska Coastal Management Program and that the project will be conducted in a manner consistent with that program.

Any person desiring to present views pertaining to the project's compliance or consistency with the Alaska Coastal Management Program may do so by providing his views in writing to the Division of Governmental Coordination, Office of Management and Budget, Pouch AW, Juneau, AK 99811, within 30 days of publication of this notice.

Attachment 2

2-850259, 2-850260, and 2-850261

[illegible]

STEVE COWPER, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

Telepnone: (907) 465-2600
Address:

P.O. Box O
Juneau, AK 99811-1800

NOTICE OF APPLICATION
FOR
STATE WATER QUALITY CERTIFICATION

Any applicant for a Federal license or permit to conduct any activity which may result in any discharge into the navigable waters must first apply for and obtain certification from the Alaska Department of Environmental Conservation that any such discharge will comply with the Clean Water Act of 1977 (PL 95-217), the Alaska Water Quality Standards and other applicable State laws. By Agreement between the U.S. Army Corps of Engineers and the Alaska Department of Environmental Conservation application for a Department of the Army Permit may also serve as application for State Water Quality Certification when such certification is necessary.

Notice is hereby given that the application for a Department of the Army Permit described in the Corps of Engineers Public Notice No. 2-850259, 2-850260, 2-850261 also serves as application for State Water Quality Certification from the Alaska Department of Environmental Conservation, as provided in Section 401 of the Clean Water Act of 1977 (PL 95-217).

The Department will review the proposed activity to insure that any discharge to waters of the United States resulting from the referenced project will comply with the Clean Water Act of 1977 (PL 95-217) the Alaska Water Quality Standards and other applicable State laws.

Any person desiring to comment on the water quality impacts of the proposed project may do so by writing to:

Alaska Department of Environmental Conservation
Southcentral Regional Office
437 "E" Street, Second Floor
Anchorage, Alaska 99501
Telephone: 274-2533

within 30 days of publication of this notice.

Attachment 3

United States Environmental Protection Agency
Region 10
Park Place Building, 13th Floor
1200 Sixth Avenue, WD-134
Seattle, Washington 98101
(206) 442-1214

NOTICE OF PROPOSED ISSUANCE OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMITS TO DISCHARGE TO WATERS OF THE UNITED STATES, NOTICE OF DRAFT ENVIRONMENTAL IMPACT STATEMENT, NOTICE OF PUBLIC HEARING, NOTICE OF STATE CERTIFICATION, and NOTICE OF STATE DETERMINATION OF CONSISTENCY WITH THE ALASKA COASTAL MANAGEMENT PROGRAM

Public Notice Nos.: AK-004357-5
AK-004356-7
AK-004331-1
AK-004685-0

Public Notice Issuance Date: July 15, 1988

Public Notice Expiration Date: September 13, 1988

1. **Applicants**

Diamond Alaska Coal Company
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501
Application No. AK-004357-5 (coal mine)

Tidewater Services Company
(c/o Diamond Alaska Coal Co.)
Application Nos.: AK-004356-7 (housing facility)
AK-004685-0 (Ladd coal loading facility)

Granite Point Coal Port, Inc.
(c/o Diamond Alaska Coal Co.)
Application No. AK-004331-1 (coal port)

a. The Diamond Alaska Coal Company proposes to develop a coal mine and associated areas, collectively known as the Diamond Chuitna Project, located on the northwestern side of Cook Inlet near Tyonek, Alaska. The project consists of the mine, housing facilities, coal port and coal loading facility.

The Diamond Chuitna Mine is scheduled to produce two million tons of coal annually by the fourth year and reach the planned maximum production of 12 million tons annually in the seventh year of operation. Coal would be crushed at the mine site and moved by overland conveyor or truck to the port and coal loading facilities.

The housing complex (operated by Tidewater Services) will accommodate the employees of the project. Living, dining, recreation, security, transportation, first aid, and administrative services will be provided.

The Granite Point Coal Port will include facilities for coal handling, service and administration, and storage of consumables and spare parts. A pier and conveyor system would extend to deep water in Cook Inlet for coal loadout onto ocean-going colliers.

The Ladd Coal Loading Facility will receive coal from the mine hauled by truck. Stockpiled coal will be transferred to barges via conveyor. Runoff and equipment washdown water will be drained to a storm drainage pond for treatment prior to discharge to Cook Inlet.

Discharges are to Lone Creek, Chuitna River, Cook Inlet, and unnamed tributaries to the Chuitna River. The freshwaters are classified by the Alaska State Water Quality Standards as classes (1)(A)(i)(ii)(iii)(iv), (B)(i)(ii) and (C) for use in drinking, agriculture, aquaculture and industrial water supply, contact and secondary water recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife including waterfowl and furbearers. The marine waters are classified as classes (2)(A)(i)(ii)(iii), (B)(i)(ii), (C), and (D) for use in aquaculture, seafood processing, and industrial water supply, contact and secondary water recreation, growth and propagation of fish, shellfish, other aquatic life, and wildlife, and harvesting for consumption of raw mollusks or other raw aquatic life [18 AAC 70.020].

Fact Sheets, which explain the bases for the permits, have been prepared.

b. The National Environmental Policy Act (NEPA) requires that a detailed statement be prepared for every major federal action with a potential for significantly affecting the quality of the human environment. This statement, called an Environmental Impact Statement (EIS), evaluates the potential environmental effects of such federal actions in addition to identifying alternatives to the proposal. The Environmental Protection Agency's (EPA's) NPDES regulations state that the issuance of an NPDES permit to a new source may be a major federal action and therefore subject to the NEPA requirements.

NPDES permits are required for the proposed mining, housing, coal port, and coal loading facilities. The mine, coal port and coal loading facility have been determined to be new sources under the NPDES regulation definitions 40 CFR 122.2. An environmental review conducted for the project proposal shows that significant environmental impacts may occur. Therefore, the issuance of NPDES permits to the proposed facilities is a major federal action requiring the preparation of an EIS.

c. A draft EIS has been prepared and is being released for concurrent public review with the proposed NPDES permits. The draft EIS considers the environmental impacts of the proposal as well as project alternatives. Environmental, cultural, social, and economic impacts on the region in particular and the State of Alaska in general, are discussed at some length.

2. Tentative Determination

The Region 10 Office of EPA has tentatively determined to issue NPDES permits to the above listed applicants.

3. State Certification

This Notice will also serve as Public Notice of the intent of the State of Alaska, Department of Environmental Conservation, to consider certifying that the subject discharges will comply with the applicable provisions of Sections 208(e), 301, 302, 303, 306 and 307 of the Clean Water Act. The NPDES permits will not be issued until the certification requirements of Section 401 have been met.

4. State Consistency Determination

This Notice will also serve as Public Notice of the intent of the State of Alaska, Office of Management and Budget, Division of Governmental Coordination, to review these actions for consistency with the approved Alaska Coastal Management Program.

5. Public Hearings

EPA will hold public hearings on the proposed NPDES permits and the draft EIS at the following locations and times:

August 17, 1988
7:00 p.m. to 10:00 p.m.
Federal Building
Conference Room (1st Floor)
701 "C" Street
Anchorage, Alaska

August 18, 1988
7:00 p.m. to 10:00 p.m.
Tyonek Community Center
Tyonek, Alaska

6. Public Comments

Persons wishing to comment on the tentative determinations contained in the proposed permits, may do so orally or in writing at the hearing, or by submitting written comments. Oral comments will only be accepted at the hearing. Written comments must be submitted by September 13, 1988, to be considered in the formulation of final determinations regarding the permits. All comments should include the name, address and telephone number of the commenter and a concise statement of the exact basis of any comment and the relevant facts upon which it is based.

All written comments should be submitted to EPA at the above address to the attention of the Director, Water Division.

Persons wishing to comment on State Certification should submit written comments within this 30-day period to the State of Alaska, Southcentral Regional Office, Alaska Department of Environmental Conservation (ADEC), 3601 "C" Street, Suite 1350, Anchorage, Alaska 99503.

Persons wishing to comment on the State Determination of Consistency with the Alaska Coastal Management Program should submit written comments within this 30-day period, to the State of Alaska, Southcentral Regional Office, Office of Management and Budget, Division of Governmental Coordination, 2600 Denali Street, Suite 700, Anchorage, Alaska 99503. Comments should be addressed to the attention of Alaska Coastal Management Program Consistency Review.

7. **Administrative Record**

The proposed NPDES permits and other related documents are on file and may be inspected and copies made at the above address any time between 8:30 a.m. and 4:00 p.m., Monday through Friday. Copies and other information may be requested by writing to the EPA at the above address to the attention of the Water Permits Section, or by calling (206) 442-1214. This material is also available from the EPA Alaska Operations Office, Room E551, Federal Bldg., 701 C Street, Box 19, Anchorage, Alaska 99513.

Fact Sheet

United States Environmental Protection Agency
Region 10
Park Place Building, 13th Floor
1200 Sixth Avenue, WD-134
Seattle, Washington 98101
(206) 442-1214

Application No : AK-004357-5 **Date: July 15, 1988**

PROPOSED ISSUANCE OF A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE POLLUTANTS PURSUANT TO THE PROVISIONS OF THE CLEAN WATER ACT

Diamond Alaska Coal Company
(Diamond Chuitna Mine)
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

has applied for issuance of a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants pursuant to the provisions of the Clean Water Act. This fact sheet includes (a) the tentative determination of the Environmental Protection Agency (EPA) to issue the permit, (b) information on public comment, public hearing and appeal procedures, (c) the description of the proposed discharge, (d) a listing of tentative effluent limitations, schedules of compliance and other conditions, and (e) a detailed description of the discharge location. We call your special attention to the technical material presented in the latter part of this document.

Persons wishing to comment on the tentative determinations contained in the proposed permit issuance may do so by the expiration date of the Public Notice. All written comments should be submitted to EPA as described in the Public Comments section of the attached Public Notice.

After the expiration date of the Public Notice, the Director, EPA Water Division, will make final determinations with respect to the permit issuance. The tentative determinations contained in the draft permit will become final conditions if no substantive comments are received during the Public Notice period.

The permit will become effective 30 days after the final determinations are made, unless a request for an evidentiary hearing is submitted within 30 days after receipt of the final determinations.

The proposed NPDES permit and other related documents are on file, may be inspected, and copies made at the above address any time between 8:30 a.m. and 4:00 p.m., Monday through Friday. Copies and other information may be requested by writing to EPA at the above address to the attention of the Water Permits Section, or by calling (206) 442-1214. This material is also available from the EPA Alaska Operations Office, Room E551, Federal Bldg., 701 C Street, Box 19, Anchorage, Alaska 99513.

Technical Information

I. Applicant

A. Diamond Alaska Coal Company
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

B. NPDES permit number AK-004357-5.

II. Activity

Diamond Alaska Coal Company proposes to develop the Diamond Chuitna surface coal mine on the northwestern side of Cook Inlet near Tyonek, Alaska. Coal production is scheduled to start at 2 million tons annually by the fourth year and reach the planned maximum production of 12 million tons annually in the seventh year of operation. The expected life of the project is approximately 34 years. This project is a "new source" pursuant to the definition of 40 CFR 122.2. An environmental impact statement has been prepared.

III. Receiving Waters

A. Lone Creek, Chuitna River, and unnamed tributaries of the Chuitna River are the receiving waters for the discharges specified in the NPDES permit.

B. The receiving waters are classified by the Alaska State Water Quality Standards as classes (1)(A)(i)(ii)(iii)(iv), (B)(i)(ii), and (C) for use in drinking, agriculture, aquaculture and industrial water supply, contact and secondary water recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife including waterfowl and furbearers. [18 AAC 70.020]

C. The conventional pollutants associated with the discharges are total suspended solids and pH. The nonconventional pollutant usually associated with alkaline coal mine drainage is iron.

IV. Background

On September 16, 1985, a complete NPDES permit application from Diamond Alaska Coal Co. was received for wastewater discharges from the proposed Diamond Chuitna Mine.

Diamond Alaska Coal Company proposes to develop a coal mine and associated areas, collectively known as the Diamond Chuitna Project, on lands leased from the State of Alaska. The project site is located on the north side of the Cook Inlet approximately 60 air miles west of Anchorage, Alaska. Five major, but separate, components are incorporated in the project. These components consist of the the Diamond Chuitna Mine (NPDES Permit Application No. AK-004357-5), the housing facilities (NPDES Permit Application No. AK-004356-7), transportation systems (no NPDES permit required), the Granite Point Coal Port (NPDES Permit Application No. AK-004331-1), and the Ladd coal loading facility (NPDES Permit Application No. AK-004685-0). This NPDES permit covers those discharges related to the mine.

V. Basis for Effluent Limitations

A. Outfalls 001 - 018, Mine Drainage

Effluent limitations prescribed in this permit for the control of pollutants are published as the Final Effluent Limitation Guidelines for the Coal Mining Point Source Category 40 CFR 434 (promulgated on October 13, 1983, 47 F.R. 45382).

This mining project is defined as a new source. As such, new source performance standards apply. This level of treatment will effectively control both conventional and nonconventional pollutants present in the discharges from this facility.

1. Effluent limitations presented in Part I.A.1. and 2. of this permit are in accordance with 40 CFR 434.45 and 434.63.

2. Information obtained from the permit application regarding pH and total iron concentrations expected in the mine drainage, is the basis for incorporating effluent limitations for alkaline mine drainage into the permit. The definition of alkaline mine drainage supports this determination (40 CFR 434.11).

3. Sedimentation ponds for outfalls 017 and 018 receive oil from equipment washdown water. EPA has not promulgated effluent guidelines for this type of discharge. Oil and grease limitations are therefore, based on a best professional judgment of applicable technology-based limits for an oil/water separator. The daily average oil and grease limitation is 10 mg/l with a maximum limit of 15 mg/l.

4. Alternate Effluent Limitations for Precipitation Events

   Because solid levels in the discharge from sedimentation ponds cannot be consistently controlled when precipitation events cause increases above baseflow conditions the Agency promulgated alternative effluent limitations for periods of precipitation [40 CFR 434.63(a) and (d)]. These limitations become applicable when any discharge (or increase in the volume of the discharge) is caused by precipitation or snowmelt.

   Two sets of alternate limitations have been promulgated. These are for those precipitation events (or snowmelt of equivalent volume) less than or equal to the 10-year, 24-hour precipitation event (40 CFR 434.63(a)(2)); and for those events greater than the 10-year, 24-hour precipitation event (40 CFR 434.63(d)(2)). For this area the 10-year, 24-hour precipitation event is equal to 5.1 inches.. Therefore, the two sets of alternate limitations for precipitation events less than or equal to, and greater than 5.1 inches have been included in the permit Part I.A.2.a. and b., respectively.

The alternate limitations for precipitation events less than or equal to 5.1 inches limit only settleable solids and pH. The other set only limits pH.

The document titled "Supplemental Guidance for the Coal Mining Point Source Category Effluent Limitations Guidelines" (EPA, Office of Water Effluent Guidelines Division, April 1983, draft) clarifies the alternate precipitation limitations. This guidance recommends that because the runoff resulting from precipitation may continue for hours after the precipitation event stops, the alternate effluent limitations should also continue until the area returns to baseflow conditions. This continuation period (or the period after precipitation stops and baseflow conditions are reached) is based on the estimated "time of concentration" for the drainage area and the retention time of the sedimentation pond. These time periods were provided by the applicant for each of the 18 ponds. (September 12, 1985, letter from the applicant to EPA). These two periods of time are added together to get the length of time the applicable alternate limitations remain in effect once precipitation stops. Therefore, after the precipitation event ceases, the alternate limits remain in effect for each outfall as follows:

Outfall Number	Time Period (days)
001	1
002	1
003	1
004	1
005	2
006	2
007	2
008	2
009	2
010	2
011	2
012	2
013	2
014	2
015	2
016	2
017	2
018	2

B. Outfall 019, Sanitary Waste

The permit limits are based on the secondary treatment requirements applicable to publicly-owned treatment works (40 CFR 133). They are incorporated into this permit based on best professional judgment and information submitted by the company in its NPDES permit application.

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VI. Basis of Monitoring Conditions:

A. Part I.A.1.a. of the permit includes settleable solids (SS) monitoring. This requirement is included to compare the SS levels with:

1. the TSS levels discharged during baseflow conditions, and
2. the SS levels measured during precipitation events.

This information will be used to determine any correlation between TSS and SS discharges levels.

B. Self-monitoring of permit parameters is necessary for the permittee to demonstrate compliance with effluent limitations and to assure that State Water Quality Standards are being met. Monitoring frequencies are based on the Agency's determination of the minimum sampling frequency required to adequately monitor the sedimentation pond's performance. Required sample types are based on the Agency's determination of the potential for effluent variability. These determinations take into consideration several factors, of which the most important are the type of pollutants of concern and the type of treatment system.

For this permit relatively infrequent monitoring and grab sampling are required during "Baseflow Conditions" because of the sedimentation pond reduces effluent variability. More frequent monitoring is required, however, during precipitation events to ensure the sedimentation pond is providing adequate treatment for solids removal.

Monitoring for sanitary waste discharges are also on an infrequent basis. Monthly sampling with grab samples are adequate to characterize the treatment plant's performance.

VII. Other Conditions:

A. Watershed Monitoring Program

The time period of when the alternate limits end and when the baseflow condition limits resume, is based on the "time of concentration" (t_c) and the retention time of the sedimentation pond. The t_c is the time it takes the last of the rainfall from the hydraulically most remote point in the drainage area to reach the inlet of the sedimentation pond. The t_c is therefore, dependent on several variables including the soil type, land/vegetative cover, slope of the drainage area, and drainage distance. The t_c can be estimated using empirical methods, or measured in the field.

The watershed monitoring program requires the collection of field data to verify the t_c for the drainage area contributing runoff to the sedimentation pond. Field measurements shall be collected four times a year for one year. If the monitoring program results indicate a different t_c for the seasons and/or a significant difference from the estimated t_c, than the permit will be modified to incorporate the field measured t_c.

B. To determine when the alternate limitations apply, precipitation events must be recorded and submitted to EPA and ADEC.

C. Since the mine will be developed over several years, all the sedimentation ponds will not be in operation immediately. To keep track of what sedimentation ponds will be receiving mine drainage, yearly mining plans will be submitted to EPA and ADEC.

D. Laboratory procedures described in the permit to be followed for the measurement of settleable solids are pursuant to 40 CFR 434.64. Procedures used for other measurements must be in accordance with 40 CFR 136.

E. All of the definitions in Part I.C. of the permit are pursuant to 40 CFR 122 except for "Baseflow Conditions." "Baseflow Conditions", was obtained from the glossary of the document "Surface Coal Mining in Alaska", prepared by the Committee on Alaskan Coal Mining and Reclamation (1980).

F. The permit will expire five years from the effective date of the permit.

Permit No.: AK-004357-5
Application No.: AK-004357-5

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. §1251 et seq.; the "Act"),

DIAMOND ALASKA COAL COMPANY
(Diamond Chuitna Mine)

is authorized to discharge from a facility located near the village of Tyonek, Alaska, to receiving waters named Lone Creek and Chuitna River, and unnamed tributaries to the Chuitna River, in accordance with discharge point(s), effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

DRAFT

Director, Water Division, Region 10
U.S. Environmental Protection Agency

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DRAFT

I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Specific Limitations and Monitoring Requirements.

During the term of this permit, the permittee is authorized to discharge from outfall numbers 001-019, in accordance with the limitations and requirements specified below.

1. Effluent Limitations During Baseflow Conditions

a. Discharges from outfalls 001-018 shall comply with the following limitations and monitoring requirements during baseflow conditions:

Effluent Characteristics	Effluent Limitations		Monitoring Requirements	
	Daily Avg.	Daily Max.	Frequency	Sample Type
Total Iron	3.0 mg/l	6.0 mg/l	weekly	grab
Total Suspended Solids (TSS)	35.0 mg/l	70.0 mg/l	weekly	grab
Settleable Solids (SS)	--	--	weekly	grab
pH	Not less than 6.0 standard units, nor greater than 9.0 standard units		weekly	grab
Effluent Flow (mgd)	--	--	daily	instantaneous
Receiving Stream Flow (cfs)	--	--	weekly	instantaneous

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

b. Discharges from outfalls 017 and 018 shall also comply with the following limitations and monitoring requirements, during baseflow conditions:

Effluent Characteristics	Effluent Limitations		Monitoring Requirements	
	Daily Avg.	Daily Max.	Frequency	Sample Type
Oil and Grease	10.0 mg/l	15.0 mg/l	weekly	grab

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2. **Effluent Limitations During Precipitation Events**

a. Any discharge (or increase in the volume of a discharge) from outfalls 001 - 018 caused by precipitation within any 24-hour period less than or equal to 5.10 inches (or snowmelt of equivalent depth) shall comply with the following limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Daily Max.	Monitoring Requirements Frequency	Monitoring Requirements Sample Type
Effluent Flow (mgd)	N/A	daily	instantaneous
Receiving Stream Flow (cfs)	N/A	daily	instantaneous
SS	0.5 ml/l	daily	grab
pH	not less than 6.0 standard units, nor greater than 9.0 standard units.	daily	grab

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

b. Any discharge (or increase in the volume of a discharge) from outfalls 001 - 018 caused by precipitation within any 24-hour period greater than 5.10 inches (or snowmelt of equivalent depth) shall comply with the following limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Daily Max.	Monitoring Requirements Frequency	Monitoring Requirements Sample Type
Effluent Flow (mgd)	N/A	daily	instantaneous
Receiving Stream Flow (cfs)	N/A	daily	instantaneous
pH	not less than 6.0 standard units, nor greater than 9.0 standard units.	daily	grab

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

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c. The alternate precipitation limitations and monitoring requirements in Parts I.A.2.a. or b. begin when a discharge (or an increase in the volume of a discharge) is caused by precipitation (or snowmelt of equivalent depth), and shall continue at each outfall following cessation of the precipitation event for the following time periods. After this time period elapses, the baseflow condition (Part I.A.1.) apply unless another precipitation event causes a discharge (or an increase in discharge) from the sedimentation ponds.

Outfall Number	Time Period (days)
001	1
002	1
003	1
004	1
005	2
006	2
007	2
008	2
009	2
010	2
011	2
012	2
013	2
014	2
015	2
016	2
017	2
018	2

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3. Effluent Limitations for Sanitary Discharges

a. Discharges from outfall 019 shall comply with the following limitations and monitoring requirements:

Effluent Characteristic	Effluent Limitations		Monitoring Requirements	
	Monthly Avg.	Weekly Avg.	Frequency	Sample Type
Effluent Flow (mgd)	N/A	N/A	monthly	continuous
Biochemical Oxygen Demand (BOD_5)	30 mg/l	45 mg/l	monthly	grab
TSS	30 mg/l	45 mg/l	monthly	grab
pH	not less than 6.0 standard units nor greater than 9.0 standard units		monthly	grab

The monthly average percent removal of BOD_5 and TSS shall not be less than 85%. The removal rate and associated calculations shall be submitted with each monthly Discharge Monitoring Report form.

There shall be no discharge of floating solids or visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

B. Other Permit Requirements.

1. Watershed Monitoring Program

A monitoring program shall be established in order to define relationships between soil type, vegetation, and precipitation runoff, and the rate and quality of discharge from settling ponds for the four seasons of the year. The resulting watershed hydrographs should provide documentation for determining the "time of concentration" of the area contributing runoff to the sedimentation pond. The "time of concentration" is the time it takes for the last of the runoff from the hydraulically most remote point in the drainage area to reach the inlet of sedimentation pond. The program shall include provisions for monitoring influent to the sedimentation pond and precipitation.

The permittee shall submit details of this program to EPA and the Alaska Department of Environmental Conservation (ADEC) for review and approval within 90 days of the effective date of this permit.

2. Precipitation Monitoring Program

The permittee shall keep a record of all precipitation events. This record shall include as a minimum dates, time, and precipitation amounts for each precipitation event. A copy of this record shall be submitted with the monthly discharge monitoring reports (DMR) see Part II.C.

3. Mining Plans

By December 31st of every year, the permittee shall submit to EPA and ADEC a map(s) showing those areas that have been mined, those areas to be mined for the next year, and the sedimentation ponds affected by mining operations. This map should also indicate the size of the area mined (or to be mined) in acres.

C. Definitions.

1. **"Average monthly discharge limitation"** means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

2. **"Maximum daily discharge limitation"** means the highest allowable "daily discharge."

3. **"Daily discharge"** means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

4. A **"24-hour composite"** sample shall mean a flow-proportioned mixture of not less than 8 discrete aliquots. Each aliquot shall be a grab sample of not less than 100 ml and shall be collected and stored in accordance with procedures prescribed in the most recent edition of Standard Methods for the Examination of Water and Wastewater.

5. A **"Grab"** sample is a single sample or measurement taken at a specific time or over as short a period of time as is feasible.

6. **"Upset"** means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

7. **"Bypass"** means the intentional diversion of waste streams from any portion of a treatment facility.

8. **"Severe property damage"** means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

9. **"Baseflow Conditions"** refers to the sustained flow of water in rivers and streams resulting primarily from groundwater seepage into the water courses.

10. **"Precipitation Event"** includes any period of time for which there has been measurable precipitation, and periods of snowmelt (occurring at any time there is snow on the ground within the watershed and the temperature is above 0°C).

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. **Representative Sampling.**. Samples taken in compliance with the monitoring requirements established under Part I shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. **Monitoring Procedures.**

1. **Settleable Solids.** Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating material occurs, do not include the floating material in the reading.

2. **Other Parameters.** Monitoring for other parameters must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

C. **Reporting of Monitoring Results.** Monitoring results shall be summarized each month on the Discharge Monitoring Report (DMR) form (EPA No. 3320-1). The reports shall be submitted monthly and are to be postmarked by the 10th day of the following month. Legible copies of these, and all other reports, shall be signed and certified in accordance with the requirements of **Part IV.H., Signatory Requirements**, and submitted to the Director, Water Division and the State agency at the following addresses:

original to: United States Environmental Protection Agency (EPA)
Region 10
1200 Sixth Avenue, WD-135
Seattle, Washington 98101

copy to: Alaska Department of Environmental Conservation (ADEC)
Southcentral Region
3601 "C" Street, Suite 1350
Anchorage, Alaska 99503

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D. **Additional Monitoring by the Permittee.** If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

E. **Records Contents.** Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

F. **Retention of Records.** The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director or ADEC at any time. Data collected on-site, copies of Discharge Monitoring Reports, and a copy of this NPDES permit must be maintained on-site during the duration of activity at the permitted location.

G. **Twenty-four Hour Notice of Noncompliance Reporting.**

1. The following occurrences of noncompliance shall be reported by telephone within 24 hours from the time the permittee becomes aware of the circumstances:
    a. Any noncompliance which may endanger health or the environment;
    b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See Part III.G., Bypass of Treatment Facilities.);
    c. Any upset which exceeds any effluent limitation in the permit (See Part III.H., Upset Conditions.); or
    d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit to be reported within 24 hours.

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2. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected; and

   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Water Compliance Section in Seattle, Washington, by phone, (206) 442-1213.

4. Reports shall be submitted to the addresses in Part II.C., Reporting of Monitoring Results.

H. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.C. are submitted. The reports shall contain the information listed in Part II.G.2.

I. Inspection and Entry. The permittee shall allow the Director, ADEC, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. **Penalties for Violations of Permit Conditions.**

1. **Civil Penalty.** The Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be subject to a civil penalty, not to exceed $25,000 per day for each violation.

2. **Criminal Penalties:**

   a. **Negligent Violations.** The Act provides that any person who negligently violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or by both.

   b. **Knowing Violations.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or by both.

   c. **Knowing Endangerment.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. A person which is an organization shall, upon conviction of violating this subparagraph, be subject to a fine of not more than $1,000,000.

   d. **False Statements.** The Act provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more that $10,000, or by imprisonment for not more than 2 years, or by both.

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Except as provided in permit conditions in **Part III.G., Bypass of Treatment Facilities** and **Part III.H., Upset Conditions,** nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. **Need to Halt or Reduce Activity not a Defense**. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. **Duty to Mitigate**. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. **Proper Operation and Maintenance**. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. **Removed Substances**. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

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G. **Bypass of Treatment Facilities:**

1. **Bypass not exceeding limitations.** The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this section.

2. **Notice:**

   a. **Anticipated bypass.** If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 10 days before the date of the bypass.

   b. **Unanticipated bypass.** The permittee shall submit notice of an unanticipated bypass as required under **Part II.G., Twenty-four Hour Notice of Noncompliance Reporting**.

3. **Prohibition of bypass.**

   a. Bypass is prohibited and the Director or ADEC may take enforcement action against a permittee for a bypass, unless:

      (1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

      (3) The permittee submitted notices as required under paragraph 2 of this section.

   b. The Director and ADEC may approve an anticipated bypass, after considering its adverse effects, if the Director and ADEC determine that it will meet the three conditions listed above in paragraph 3.a. of this section.

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H. Upset Conditions.

1. **Effect of an upset.** An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph 2 of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. **Conditions necessary for a demonstration of upset.** A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated;

   c. The permittee submitted notice of the upset as required under **Part II.G., Twenty-four Hour Notice of Noncompliance Reporting;** and

   d. The permittee complied with any remedial measures required under **Part III.D., Duty to Mitigate.**

3. **Burden of proof.** In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

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IV. GENERAL REQUIREMENTS

A. **Changes in Discharge of Toxic Substances.** Notification shall be provided to the Director and ADEC as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. One hundred micrograms per liter (100 ug/l);

   b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

   c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

   d. The level established by the Director in accordance with 40 CFR 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. Five hundred micrograms per liter (500 ug/l);

   b. One milligram per liter (1 mg/l) for antimony;

   c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

   d. The level established by the Director in accordance with 40 CFR 122.44(f).

B. **Planned Changes.** The permittee shall give notice to the Director and ADEC as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR 122.29(b); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under Part IV.A.1.

C. **Anticipated Noncompliance.** The permittee shall also give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

D. **Permit Actions.** This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

E. **Duty to Reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit.

F. **Duty to Provide Information.** The permittee shall furnish to the Director and ADEC, within a reasonable time, any information which the Director or ADEC may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director or ADEC, upon request, copies of records required to be kept by this permit.

G. **Other Information.** When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director or ADEC, it shall promptly submit such facts or information.

H. **Signatory Requirements.** All applications, reports or information submitted to the Director and ADEC shall be signed and certified.

1. All permit applications shall be signed as follows:

    a. For a corporation: by a responsible corporate officer.

    b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

    c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director or ADEC shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

    a. The authorization is made in writing by a person described above and submitted to the Director and ADEC, and

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b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. **Changes to authorization.** If an authorization under paragraph IV.H.2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.H.2. must be submitted to the Director and ADEC prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. **Certification.** Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I. **Availability of Reports.** Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director and ADEC. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

J. **Oil and Hazardous Substance Liability.** Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

K. **Property Rights.** The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. Severability. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

N. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Act.

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Fact Sheet

United States Environmental Protection Agency
Region 10
Park Place Building, 13th Floor
1200 Sixth Avenue, WD-134
Seattle, Washington 98101
(206) 442-1214

Application No.: AK-004356-7 **Date: July 15, 1988**

PROPOSED ISSUANCE OF A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE POLLUTANTS PURSUANT TO THE PROVISIONS OF THE CLEAN WATER ACT

Tidewater Services Company (operator)
(Housing Facilities)
Diamond Shamrock Chuitna Coal Joint Venture
c/o Diamond Alaska Coal Company
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

has applied for a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants pursuant to the provisions of the Clean Water Act. This fact sheet includes (a) the tentative determination of the Environmental Protection Agency (EPA) to issue the permit, (b) information on public comment, public hearing and appeal procedures, (c) the description of the proposed discharge, (d) a listing of tentative effluent limitations, schedules of compliance and other conditions, and (e) a sketch or detailed description of the discharge location. We call your special attention to the technical material presented in the latter part of this document.

Persons wishing to comment on the tentative determinations contained in the proposed permit issuance may do so by the expiration date of the Public Notice. All written comments should be submitted to EPA as described in the Public Comments Section of the attached Public Notice.

After the expiration date of the Public Notice, the Director, Water Division, will make final determinations with respect to the permit issuance. The tentative determinations contained in the draft permit will become final conditions if no substantive comments are received during the Public Notice period.

The permit will become effective 30 days after the final determinations are made, unless a request for an evidentiary hearing is submitted within 30 days after receipt of the final determinations.

The proposed NPDES permit and other related documents are on file, may be inspected, and copies made at the above address any time between 8:30 a.m. and 4:00 p.m., Monday through Friday. Copies and other information may be requested by writing to EPA at the above address to the attention of the Water Permits Section, or by calling (206) 442-1214. This material is also available from the EPA Alaska Operations Office, Room E-551, Federal Bldg., 701 C Street, Box 19, Anchorage, Alaska 99513.

TECHNICAL INFORMATION

1. **Applicant**

Tidewater Services Company (operator)
(Housing Facilities)
Diamond Shamrock Chuitna Coal Joint Venture
c/o Diamond Alaska Coal Company
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

2. **Project Location**

North Side of Cook Inlet
60 air miles west of Anchorage
near the village of Tyonek

3. **Project Description**

Diamond Alaska Coal Company proposes to develop a coal mine and associated areas, collectively known as the Diamond Chuitna Project, on lands leased from the State of Alaska. The project site is located on the north side of the Cook Inlet approximately 60 air miles west of Anchorage, Alaska. Five major, but separate, components are incorporated in the project. These components consist of the housing facilities (NPDES Permit Application No. AK-004356-7), the Diamond Chuitna Mine (NPDES Permit Application No. AK-004357-5), transportation systems (no NPDES permit required), the Granite Point Coal Port (NPDES Permit Application No. AK-004331-1), and the Ladd coal loading facility (NPDES Permit Application No. AK-004685-0). This NPDES permit covers those discharges related to the housing facilities.

Because of the remoteness of the mining, transportation corridor, port, and coal loading facility from Anchorage and other Alaska communities, a housing complex is proposed to provide accommodations for approximately 450 employees. Tidewater Services Co., will be the operator for the housing facility.

4. **Proposed Discharges**

The proposed discharges associated with the housing complex are treated sanitary waste (outfall 001) and surface runoff (outfalls 002 and 003). All three sources are defined as "new dischargers" pursuant to 40 CFR 122.2.

The sanitary waste will be treated in a package commercial sewage treatment plant with an approximate capacity of 30,000 gpd.

Surface runoff during and after construction in the housing area will be collected and routed to two sediment treatment ponds. These ponds have been designed to hold approximately 75% of the runoff volume from a 10-year, 24-hour precipitation event, plus the sediment load for three years from the drainage basin.

5. **Receiving Waters**

The three outfalls will discharge to tributaries of the Chuitna River or the Chuitna River. These receiving waters are protected for all uses by the State of Alaska water quality standards, including water supply, water recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife including waterfowl and furbearers. [18 AAC 70.020]

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6. Basis for Permit Limitations

a. Outfall 001: Sanitary Waste Discharges

The permit limits are based on the secondary treatment requirements applicable to publicly owned treatment works (40 CFR 133). They are incorporated into this permit based on best professional judgment and information submitted by the company in its NPDES permit application. These are as follows:

	Monthly Avg.	Weekly Avg.
Biochemical Oxygen Demand (BOD)	30 mg/l	45 mg/l
Total Suspended Solids (TSS)	30 mg/l	45 mg/l
pH	6.0 to 9.0 standard units	
BOD and TSS:	85% removal	

b. Outfalls 002 and 003: Sediment Pond Discharges

EPA has not promulgated any effluent guidelines for surface runoff from housing areas. Therefore, the permit limits are based on a best professional judgement of applicable technology-based limits. The sediment pond discharge limits are based on the expected efficiency of similar ponds designed elsewhere in Alaska. In ore mining projects, the effluent guidelines limit TSS to a 20 mg/l monthly average and a 30 mg/l daily maximum for a sediment pond technology. The coal mining effluent guidelines limit TSS to a 35 mg/l monthly average for a similar technology. Since the housing area is not part of the active mining area (where coal dust will not be part of the runoff) the TSS limit will be based on the ore mining guidelines.

In addition, a settleable solids limit of 0.2 ml/l will be included. This limit has been shown to be achievable for properly sized, operated and maintained settling ponds. (Evaluation of Settleable Solids Removal, Alaska Gold Placer Mines, (July 11-21, 1977), September 1977, EPA-330/2-77-021, Wash. D.C.).

7. Basis for Monitoring Requirements

Self-monitoring of permit parameters is necessary for the permittee to demonstrate compliance with effluent limitations and to assure that State Water Quality Standards are being met. Monitoring frequencies are based on the Agency's determination of the minimum sampling frequency required to adequately monitor the sedimentation pond's performance. Required sample types are based on the Agency's determination of the potential for effluent variability. These determinations take into consideration several factors, of which the most important are the type of pollutants of concern and the type of treatment system.

For this permit relatively infrequent monitoring and grab sampling are required because of the sedimentation pond reduces effluent variability.

Monitoring for sanitary waste discharges are also on an infrequent basis. Monthly sampling with grab samples are adequate to characterize the treatment plant's performance.

8. Other Conditions

The permit will expire five years from the effective date of the permit.

Permit No.: AK-004356-7
Application No.: AK-004356-7

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. §1251 et seq; the "Act"),

TIDEWATER SERVICES COMPANY
(Housing Facilities)
Diamond Shamrock Chuitna Coal Joint Venture

is authorized to discharge from a facility located near the village of Tyonek, Alaska, to receiving waters named the tributaries of the Chuitna River and the Chuitna River, jn accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

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Director, Water Division, Region 10
U.S. Environmental Protection Agency

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Specific Limitations and Monitoring Requirements for Outfall 001.

During the effective term of this permit, the permittee is authorized to discharge from outfall 001 (sanitary waste) in accordance with the following effluent limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Monthly Avg.	Weekly Avg.	Monitoring Requirements Frequency	Sample Type
Biochemical Oxygen Demand (BOD_5)	30 mg/l	45 mg/l	monthly	grab
Total Suspended Solids (TSS)	30 mg/l	45 mg/l	monthly	grab
pH	Not less than 6.0 standard units, nor greater than 9.0 standard units.		monthly	grab
Flow, mgd	--	--	monthly	instantaneous

The monthly average percent removal of BOD_5 and TSS shall not be less than 85%. Removal rates and associated calculations shall be submitted monthly with each Discharge Monitoring Report (DMR) form.

There shall be no discharge of floating solids or visible foam.

B. Specific Limitations and Monitoring Requirements for Outfalls 002 and 003.

During the effective term of this permit, the permittee is authorized to discharge from outfalls 002 and 003 (sediment ponds) in accordance with the following effluent limitations and monitoring requirements:

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATION Daily Avg.	Daily Max.	MONITORING REQUIREMENTS Frequency	Sample Type
TSS	20.0 mg/l	30.0 mg/l	weekly	grab
Settleable Solids (SS)	--	0.2 ml/l	weekly	grab
pH	Not less than 6.0 standard units, nor greater than 9.0 standard units.		weekly	grab
Flow, mgd	--	--	weekly	instantaneous

There shall be no discharge of floating solids or visible foam.

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C. **Definitions.**

1. **"Average monthly discharge limitation"** means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

2. **"Maximum daily discharge limitation"** means the highest allowable "daily discharge."

3. **"Daily discharge"** means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

4. A **"Grab" sample** is a single sample or measurement taken at a specific time or over as short a period of time as is feasible.

5. **"Upset"** means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

6. **"Bypass"** means the intentional diversion of waste streams from any portion of a treatment facility.

7. **"Severe property damage"** means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. **Representative Sampling.** Samples taken in compliance with the monitoring requirements established under Part I shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. **Monitoring Procedures.**

1. **Settleable Solids.** Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating material occurs, do not include the floating material in the reading.

2. **Other Parameters.** Monitoring for other parameters must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

C. **Reporting of Monitoring Results.** Monitoring results shall be summarized each month on the Discharge Monitoring Report (DMR) form (EPA No. 3320-1). The reports shall be submitted monthly and are to be postmarked by the 10th day of the following month. Legible copies of these, and all other reports, shall be signed and certified in accordance with the requirements of **Part IV.H., Signatory Requirements,** and submitted to the Director, Water Division and the State agency at the following addresses:

original to: United States Environmental Protection Agency (EPA)
Region 10
1200 Sixth Avenue, WD-135
Seattle, Washington 98101

copy to: Alaska Department of Environmental Conservation (ADEC)
Southcentral Region
3601 "C" Street, Suite 1350
Anchorage, Alaska 99503

D. **Additional Monitoring by the Permittee.** If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

E. **Records Contents.** Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

F. **Retention of Records.** The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director or ADEC at any time. Data collected on-site, copies of Discharge Monitoring Reports, and a copy of this NPDES permit must be maintained on-site during the duration of activity at the permitted location.

G. **Twenty-four Hour Notice of Noncompliance Reporting.**

1. The following occurrences of noncompliance shall be reported by telephone within 24 hours from the time the permittee becomes aware of the circumstances:
   a. Any noncompliance which may endanger health or the environment;
   b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See Part III.G., Bypass of Treatment Facilities.);
   c. Any upset which exceeds any effluent limitation in the permit (See Part III.H., Upset Conditions.); or
   d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit to be reported within 24 hours.

2. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected; and

   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Water Compliance Section in Seattle, Washington, by phone, (206) 442-1213.

4. Reports shall be submitted to the addresses in Part II.C., Reporting of Monitoring Results.

H. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.C. are submitted. The reports shall contain the information listed in Part II.G.2.

I. Inspection and Entry. The permittee shall allow the Director, ADEC, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

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III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions.

1. **Civil Penalty.** The Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be subject to a civil penalty, not to exceed $25,000 per day for each violation.

2. **Criminal Penalties:**

a. **Negligent Violations.** The Act provides that any person who negligently violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or by both.

b. **Knowing Violations.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or by both.

c. **Knowing Endangerment.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. A person which is an organization shall, upon conviction of violating this subparagraph, be subject to a fine of not more than $1,000,000.

d. **False Statements.** The Act provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more that $10,000, or by imprisonment for not more than 2 years, or by both.

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Except as provided in permit conditions in **Part III.G., Bypass of Treatment Facilities** and **Part III.H., Upset Conditions,** nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. **Need to Halt or Reduce Activity not a Defense**. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. **Duty to Mitigate**. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. **Proper Operation and Maintenance**. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. **Removed Substances**. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

G. **Bypass of Treatment Facilities:**

1. **Bypass not exceeding limitations.** The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this section.

2. **Notice:**

   a. **Anticipated bypass.** If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 10 days before the date of the bypass.

   b. **Unanticipated bypass.** The permittee shall submit notice of an unanticipated bypass as required under **Part II.G., Twenty-four Hour Notice of Noncompliance Reporting**.

3. **Prohibition of bypass.**

   a. Bypass is prohibited and the Director or ADEC may take enforcement action against a permittee for a bypass, unless:

      (1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

      (3) The permittee submitted notices as required under paragraph 2 of this section.

   b. The Director and ADEC may approve an anticipated bypass, after considering its adverse effects, if the Director and ADEC determine that it will meet the three conditions listed above in paragraph 3.a. of this section.

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H. Upset Conditions.

1. **Effect of an upset.** An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph 2 of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. **Conditions necessary for a demonstration of upset.** A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated;

   c. The permittee submitted notice of the upset as required under Part II.G., Twenty-four Hour Notice of Noncompliance Reporting; and

   d. The permittee complied with any remedial measures required under Part III.D., Duty to Mitigate.

3. **Burden of proof.** In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

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IV. GENERAL REQUIREMENTS

A. Changes in Discharge of Toxic Substances. Notification shall be provided to the Director and ADEC as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. One hundred micrograms per liter (100 ug/l);

   b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

   c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

   d. The level established by the Director in accordance with 40 CFR 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. Five hundred micrograms per liter (500 ug/l);

   b. One milligram per liter (1 mg/l) for antimony;

   c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

   d. The level established by the Director in accordance with 40 CFR 122.44(f).

B. Planned Changes. The permittee shall give notice to the Director and ADEC as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR 122.29(b); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under Part IV.A.1.

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C. **Anticipated Noncompliance**. The permittee shall also give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

D. **Permit Actions**. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

E. **Duty to Reapply**. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit.

F. **Duty to Provide Information**. The permittee shall furnish to the Director and ADEC, within a reasonable time, any information which the Director or ADEC may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director or ADEC, upon request, copies of records required to be kept by this permit.

G. **Other Information**. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director or ADEC, it shall promptly submit such facts or information.

H. **Signatory Requirements**. All applications, reports or information submitted to the Director and ADEC shall be signed and certified.

1. All permit applications shall be signed as follows:

   a. For a corporation: by a responsible corporate officer.

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

   c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director or ADEC shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director and ADEC, and

b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. **Changes to authorization.** If an authorization under paragraph IV.H.2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.H.2. must be submitted to the Director and ADEC prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. **Certification.** Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I. **Availability of Reports**. Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director and ADEC. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

J. **Oil and Hazardous Substance Liability**. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

K. **Property Rights**. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. **Severability**. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. **Transfers**. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;
2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and
3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

N. **State Laws**. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Act.

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Fact Sheet

United States Environmental Protection Agency
Region 10
Park Place Building, 13th Floor
1200 Sixth Avenue, WD-134
Seattle, Washington 98101
(206) 442-1214

Application No.: AK-004331-1 **Date: July 15, 1988**

PROPOSED ISSUANCE OF A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE POLLUTANTS PURSUANT TO THE PROVISIONS OF THE CLEAN WATER ACT

Granite Point Coal Port, Inc.
Diamond Shamrock Chuitna Coal Joint Venture
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

has applied for a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants pursuant to the provisions of the Clean Water Act. This fact sheet includes (a) the tentative determination of the Environmental Protection Agency (EPA) to issue the permit, (b) information on public comment, public hearing and appeal procedures, (c) the description of the proposed discharge, (d) a listing of tentative effluent limitations, schedules of compliance and other conditions, and (e) a sketch or detailed description of the discharge location. We call your special attention to the technical material presented in the latter part of this document.

Persons wishing to comment on the tentative determinations contained in the proposed permit issuance may do so by the expiration date of the Public Notice. All written comments should be submitted to EPA as described in the Public Comments Section of the attached Public Notice.

After the expiration date of the Public Notice, the Director, Water Division, will make final determinations with respect to the permit issuance. The tentative determinations contained in the draft permit will become final conditions if no substantive comments are received during the Public Notice period.

The permit will become effective 30 days after the final determinations are made, unless a request for an evidentiary hearing is submitted within 30 days after receipt of the final determinations.

The proposed NPDES permit and other related documents are on file, may be inspected, and copies made at the above address any time between 8:30 a.m. and 4:00 p.m., Monday through Friday. Copies and other information may be requested by writing to EPA at the above address to the attention of the Water Permits Section, or by calling (206) 442-1214. This material is also available from the EPA Alaska Operations Office, Room E551, Federal Bldg., 701 C Street, Box 19, Anchorage, Alaska 99513.

TECHNICAL INFORMATION

1. **Applicant:**

Granite Point Coal Port, Inc. (operator)
Diamond Shamrock Chuitna Coal
Joint Venture
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

2. **Project Location:** Northwest side of Cook Inlet and southwest of the village of Tyonek

3. **Project Description:**

The applicant proposes to develop a coal shipping facility. This facility would be developed in conjunction with the Diamond Chuitna surface coal mine (NPDES Permit Application No. AK-004357-5), housing facilities (NPDES Permit Application No. AK-004356-7), the Ladd coal loading facility (NPDES Permit Application No. AK-004685-0) and a transportation system (no NPDES permit required). The shipping facility consists of onshore and offshore facilities.

The onshore port area would include facilities for coal storage and handling, service and administration, and storage of consumables and spare parts. The coal handling area would have a stockpile capacity of 1.2 million tons (about 6 weeks of production). Other facilities would include fire protection, portable water system, sewage treatment plant, contaminated water treatment facility, and a port access road.

The offshore port area would include an approach trestle, berth, ship loader, and trestle conveyor to transport coal from the stockpile to the shiploader.

4. **Proposed Discharges:**

The applicant proposes to discharge treated sanitary effluent (outfall 001) and surface water runoff from a sediment pond system (outfall 002).

The sanitary waste will be treated by a package type commercial treatment plant. The expected flow is 2000 gpd. This source is a "new discharger" pursuant to the definition of 40 CFR 122.2.

The sedimentation pond system will collect equipment washdown water and surface water runoff from the coal storage and surrounding areas. Equipment washdown wastewater will be generated by washing coal dust from the transfer houses, stack-reclaimers, and bulldozers, and from the repair and maintenance shop. The equipment washdown water will be collected and routed through an oil and grease separator before it is routed to the two sedimentation ponds. The effluent from both ponds are combined prior to discharge. The expected total discharge is 242,200 gpd. This source is a "new source" pursuant to the definition of 40 CFR 122.2.

5. Receiving Waters:

Both outfall lines will parallel the trestle and discharge 6,527 feet offshore to Cook Inlet at 10 feet below the water surface at mean lower low water. Cook Inlet is protected for all uses by the Alaska State Water Quality Standards, including water supply, water recreation, and growth and propagation of fish, shellfish, aquatic life, wildlife including seabirds, waterfowl, and furbearers, and harvesting for consumption of raw mollusks or other raw aquatic life. [18 AAC 70.020]

6. **Basis of Permit Limitations:**

A. Outfall 001: Sanitary Waste Treatment Pond

The permit limits are based on the secondary treatment requirements applicable to publicly-owned treatment works (40 CFR 133). They are incorporated into this permit based on best professional judgment and information submitted by the company in its NPDES permit application.

B. Outfall 002: Sediment Pond System

The permit limits are based on the "Coal Preparation Plant Associated Area" new source performance standards [40 CFR 434.25(b)]. Even though this loading facility does not include a preparation plant, the surface coal pile runoff is included in the "coal preparation plant associated areas" definition (40 CFR 434.11(f)). These standards limit total iron, total suspended solids (TSS), and pH. Manganese limitations are excluded based on the Final Rule of October 9, 1985, stating that such limitations apply only to preparation plant associated areas that are described as having acid or ferruginous mine drainage (50 F.R. 41296). This mine has alkaline drainage, based on the definition of 40 CFR 434.11.

The sedimentation pond will be receiving oils and grease from the equipment washdown water. The permit therefore, also limits these pollutants. Since EPA has not promulgated effluent guidelines for this type of wastewater, the oil and grease limitations in this permit are based on a best professional judgment of applicable technology-based limits for an oil/water separator. The daily average oil and grease limitation is 10 mg/l with a maximum concentration of 15 mg/l.

Alternate Effluent Limitations for Precipitation Events

Because solid levels in the discharge from the sediment pond cannot be consistently controlled when precipitation events cause increases above baseflow conditions the Agency promulgated

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alternative effluent limitations for periods of precipitation [40 CFR 434.63(a) and (d)]. These limitations become applicable when any discharge (or increase in the volume of the discharge) is caused by precipitation or snowmelt.

Two sets of alternate limitations have been promulgated . These are for those precipitation events (or snowmelt of equivalent volume) less than or equal to the 10-year, 24-hour precipitation event (40 CFR 434.63(a)(2)); and for those events greater than the 10-year, 24-hour precipitation event (40 CFR 434.63(d)(2)). For this area the 10-year, 24-hour precipitation event is equal to 5.1 inches. Therefore, the two sets of alternate limitations for precipitation events less than or equal to, and greater than 5.1 inches have been included in the permit Part I.A.2.b.(1) and (2), respectively.

The alternate limitations for precipitation events less than or equal to 5.1 inches limit only settleable solids and pH. The other set only limits pH.

The document titled "Supplemental Guidance for the Coal Mining Point Source Category Effluent Limitations Guidelines" (EPA, Office of Water Effluent Guidelines Division, April 1983, draft) clarifies the alternate precipitation limitations. This guidance recommends that because the runoff resulting from precipitation may continue for hours after the precipitation event stops, the alternate effluent limitations should also continue until the area returns to baseflow conditions. This continuation period (or the period after precipitation stops and baseflow conditions are reached) is based on the estimated "time of concentration" for the drainage area and the retention time of the sedimentation pond. For this drainage area the time of concentration is estimated to be 6.5 hours and the retention time for the pond is 25.5 hours. These two periods of time are added together to get the length of time the applicable alternate limitations remain in effect once precipitation stops. Therefore, after the precipitation event ceases, the permit continues the alternate limits for another two days.

7. **Basis of Monitoring Conditions:**

A. Part I.A.2.b. of the permit includes settleable solids (SS) monitoring. This requirement is included to compare the SS levels with:

1. the TSS levels discharged during baseflow conditions, and
2. the SS levels measured during precipitation events.

This information will also be used to determine any correlation between TSS and SS discharges levels.

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B. Self-monitoring of permit parameters is necessary for the permittee to demonstrate compliance with effluent limitations and to assure that State Water Quality Standards are being met. Monitoring frequencies are based on the Agency's determination of the minimum sampling frequency required to adequately monitor the sedimentation pond's performance. Required sample types are based on the Agency's determination of the potential for effluent variability. These determinations take into consideration several factors, of which the most important are the type of pollutants of concern and the type of treatment system.

For this permit relatively infrequent monitoring and grab sampling are required during "Baseflow Conditions" because of the sedimentation pond reduces effluent variability. More frequent monitoring is required, however, during precipitation events to ensure the sedimentation pond is providing adequate treatment for solids removal.

Monitoring for sanitary waste discharges are also on an infrequent basis. Monthly sampling with grab samples are adequate to characterize the treatment plant's performance.

8. Other Conditions:

A. Watershed Monitoring Program

The time period of when the alternate limits end and when the baseflow condition limits resume, is based on the "time of concentration" (t_c) and the retention time of the sedimentation pond. The t_c is the time it takes the last of the rainfall from the hydraulically most remote point in the drainage area to reach the inlet of the sedimentation pond. The t_c is therefore, dependent on several variables including the soil type, land/vegetative cover, slope of the drainage, and drainage distance. The t_c can be estimated using empirical methods or measured in the field.

The watershed monitoring program requires the collection of field data to verify the t_c for the drainage area area contributing runoff to the sedimentation pond. Field measurements shall be collected four times a year for one year. If the monitoring program results indicate a different t_c for the seasons and/or a significant difference from the estimated t_c, than the permit will be modified to incorporate the field measured t_c.

B. To determine when the alternate limitations apply, precipitation events must be recorded and submitted to EPA and ADEC.

C. Laboratory procedures described in the permit to be followed for the measurement of settleable solids are pursuant to 40 CFR 434.64. Procedures used for other measurements must be in accordance with 40 CFR 136.

D. All of the definitions in Part I.C. of the permit are pursuant to 40 CFR 122 except for "Baseflow Conditions." "Baseflow Conditions", was obtained from the glossary of the document "Surface Coal Mining in Alaska", prepared by the Committee on Alaskan Coal Mining and Reclamation (1980).

E. The permit will expire five years from the effective date of the permit.

Permit No.: AK-004331-1
Application No.: AK-004331-1

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. §1251 et seq; the "Act"),

GRANITE POINT COAL PORT, INC.
(Diamond Shamrock Chuitna Coal Joint Venture)

is authorized to discharge from the port site facility located southwest of the village of Tyonek, Alaska, to receiving waters named Cook Inlet, in accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

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Director, Water Division, Region 10
U.S. Environmental Protection Agency

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Specific Limitations and Monitoring Requirements.

1. During the effective term of this permit, the permittee is authorized to discharge from outfall 001 (sanitary waste) in accordance with the following effluent limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Monthly Avg.	Effluent Limitations Weekly Avg.	Monitoring Requirements Frequency	Monitoring Requirements Sample Type
Flow (mgd)	--	--	monthly	instantaneous
Biochemical Oxygen Demand (BOD_5)	30 mg/l	45 mg/l	monthly	grab
Total Suspended Solids (TSS)	30 mg/l	45 mg/l	monthly	grab
pH	Not less than 6.0 standard units, nor greater than 9.0 standard units.		monthly	grab

The monthly average percent removal of BOD_5 and TSS shall not be less than 85%. Removal rates and associated calculations shall be submitted monthly with each Discharge Monitoring Report (DMR) form.

2. During the effective term of this permit, the permittee is authorized to discharge from outfall 002 (sediment pond) in accordance with the following:

a. **Baseflow Conditions** Discharges shall comply with the following limitations and monitoring requirements during baseflow conditions:

Effluent Characteristics	Effluent Limitations Daily Avg.	Effluent Limitations Daily Max.	Monitoring Requirements Frequency	Monitoring Requirements Sample Type
Oil and Grease	10.0 mg/l	15.0 mg/l	weekly	grab
Total Iron	3.0 mg/l	6.0 mg/l	weekly	grab
Total Suspended Solids (TSS)	35.0 mg/l	70.0 mg/l	weekly	grab
Settleable Solids (SS)	--	--	weekly	grab
pH	Not less than 6.0 standard units, nor greater than 9.0 standard units		weekly	grab
Effluent Flow (mgd)	--	--	daily	instantaneous
Receiving Stream Flow (cfs)	--	--	weekly	instantaneous

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

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b. Precipitation Events (Alternate Limitations)

(1) Any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to 5.10 inches (or snowmelt of equivalent depth) shall comply with the following limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Daily Maximum	Monitoring Requirements Frequency	Sample Type
Effluent Flow (mgd)	N/A	daily	instantaneous
Receiving Stream Flow (cfs)	N/A	daily	instantaneous
SS	0.5 ml/l	daily	grab
pH	not less than 6.0 standard units, nor greater than 9.0 standard units.	daily	grab

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

(2) Any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than 5.10 inches (or snowmelt of equivalent depth) shall comply with the following limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Daily Maximum	Monitoring Requirements Frequency	Sample Type
Effluent Flow (mgd)	N/A	daily	instantaneous
Receiving Stream Flow (cfs)	N/A	daily	instantaneous
pH	not less than 6.0 standard units, nor greater than 9.0 standard units.	daily	grab

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

(3) The alternate precipitation limitations and monitoring requirements in Parts I.A.2.b.(1) or (2) begin when a discharge (or an increase in the volume of a discharge) is caused by precipitation (or snowmelt of equivalent depth), and shall continue two days following cessation of the precipitation event.

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B. Other Permit Requirements.

1. Watershed Monitoring Program

A monitoring program shall be established in order to define relationships between soil type, vegetation, and precipitation runoff, and the rate and quality of discharge from settling ponds for the four seasons of the year. The resulting watershed hydrographs should provide documentation for determining the "time of concentration" of the area contributing runoff to the sedimentation pond. The "time of concentration" is the time it takes for the last of the runoff from the hydraulically most remote point in the drainage area to reach the inlet of sedimentation pond. The program shall include provisions for monitoring influent to the sedimentation pond and precipitation.

The permittee shall submit details of this program to EPA and the Alaska Department of Environmental Conservation for review and approval within 90 days of the effective date of this permit.

2. Precipitation Monitoring Program

The permittee shall keep a record of all precipitation events. This record shall include as a minimum dates, time, and precipitation amounts for each precipitation event. A copy of this record shall be submitted with the monthly discharge monitoring reports (DMR) see Part II.C.

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C. Definitions.

1. **"Average monthly discharge limitation"** means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

2. **"Maximum daily discharge limitation"** means the highest allowable "daily discharge."

3. **"Daily discharge"** means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

4. A **"Grab"** sample is a single sample or measurement taken at a specific time or over as short a period of time as is feasible.

5. **"Upset"** means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

6. **"Bypass"** means the intentional diversion of waste streams from any portion of a treatment facility.

7. **"Severe property damage"** means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

8. **"Baseflow Conditions"** refers to the sustained flow of water in rivers and streams resulting primarily from groundwater seepage into the water courses.

9. **"Precipitation Event"** includes any period of time for which there has been measurable precipitation, and periods of snowmelt (occurring at any time there is snow on the ground within the watershed and the temperature is above 0°C).

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II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. **Representative Sampling.** Samples taken in compliance with the monitoring requirements established under Part I shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. **Monitoring Procedures.**

1. **Settleable Solids.** Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating material occurs, do not include the floating material in the reading.

2. **Other Parameters.** Monitoring for other parameters must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

C. **Reporting of Monitoring Results.** Monitoring results shall be summarized each month on the Discharge Monitoring Report (DMR) form (EPA No. 3320-1). The reports shall be submitted monthly and are to be postmarked by the 10th day of the following month. Legible copies of these, and all other reports, shall be signed and certified in accordance with the requirements of **Part IV.H., Signatory Requirements,** and submitted to the Director, Water Division and the State agency at the following addresses:

original to: United States Environmental Protection Agency (EPA)
Region 10
1200 Sixth Avenue, WD-135
Seattle, Washington 98101

copy to: Alaska Department of Environmental Conservation (ADEC)
Southcentral Region
3601 "C" Street, Suite 1350
Anchorage, Alaska 99503

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D. **Additional Monitoring by the Permittee.** If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

E. **Records Contents.** Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

F. **Retention of Records.** The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director or ADEC at any time. Data collected on-site, copies of Discharge Monitoring Reports, and a copy of this NPDES permit must be maintained on-site during the duration of activity at the permitted location.

G. **Twenty-four Hour Notice of Noncompliance Reporting.**

1. The following occurrences of noncompliance shall be reported by telephone within 24 hours from the time the permittee becomes aware of the circumstances:
   a. Any noncompliance which may endanger health or the environment;
   b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See **Part III.G., Bypass of Treatment Facilities.**);
   c. Any upset which exceeds any effluent limitation in the permit (See **Part III.H., Upset Conditions.**); or
   d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit to be reported within 24 hours.

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2. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected; and

   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Water Compliance Section in Seattle, Washington, by phone, (206) 442-1213.

4. Reports shall be submitted to the addresses in **Part II.C., Reporting of Monitoring Results**.

H. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.C. are submitted. The reports shall contain the information listed in Part II.G.2.

I. Inspection and Entry. The permittee shall allow the Director, ADEC, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

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III. COMPLIANCE RESPONSIBILITIES

A. **Duty to Comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. **Penalties for Violations of Permit Conditions.**

1. **Civil Penalty.** The Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be subject to a civil penalty, not to exceed $25,000 per day for each violation.

2. **Criminal Penalties:**

   a. **Negligent Violations.** The Act provides that any person who negligently violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or by both.

   b. **Knowing Violations.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or by both.

   c. **Knowing Endangerment.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. A person which is an organization shall, upon conviction of violating this subparagraph, be subject to a fine of not more than $1,000,000.

   d. **False Statements.** The Act provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more that $10,000, or by imprisonment for not more than 2 years, or by both.

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Except as provided in permit conditions in Part III.G., Bypass of Treatment Facilities and Part III.H., Upset Conditions, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Removed Substances. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

G. **Bypass of Treatment Facilities:**

1. **Bypass not exceeding limitations.** The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this section.

2. **Notice:**

   a. **Anticipated bypass.** If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 10 days before the date of the bypass.

   b. **Unanticipated bypass.** The permittee shall submit notice of an unanticipated bypass as required under **Part II.G., Twenty-four Hour Notice of Noncompliance Reporting**.

3. **Prohibition of bypass.**

   a. Bypass is prohibited and the Director or ADEC may take enforcement action against a permittee for a bypass, unless:

      (1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

      (3) The permittee submitted notices as required under paragraph 2 of this section.

   b. The Director and ADEC may approve an anticipated bypass, after considering its adverse effects, if the Director and ADEC determine that it will meet the three conditions listed above in paragraph 3.a. of this section.

H. Upset Conditions.

1. **Effect of an upset.** An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph 2 of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. **Conditions necessary for a demonstration of upset.** A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

    a. An upset occurred and that the permittee can identify the cause(s) of the upset;

    b. The permitted facility was at the time being properly operated;

    c. The permittee submitted notice of the upset as required under Part II.G., Twenty-four Hour Notice of Noncompliance Reporting; and

    d. The permittee complied with any remedial measures required under Part III.D., Duty to Mitigate.

3. **Burden of proof.** In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

IV. GENERAL REQUIREMENTS

A. **Changes in Discharge of Toxic Substances.** Notification shall be provided to the Director and ADEC as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. One hundred micrograms per liter (100 ug/l);

    b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

    c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

    d. The level established by the Director in accordance with 40 CFR 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. Five hundred micrograms per liter (500 ug/l);

    b. One milligram per liter (1 mg/l) for antimony;

    c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

    d. The level established by the Director in accordance with 40 CFR 122.44(f).

B. **Planned Changes.** The permittee shall give notice to the Director and ADEC as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR 122.29(b); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under Part IV.A.1.

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C. **Anticipated Noncompliance.** The permittee shall also give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

D. **Permit Actions.** This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

E. **Duty to Reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit.

F. **Duty to Provide Information.** The permittee shall furnish to the Director and ADEC, within a reasonable time, any information which the Director or ADEC may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director or ADEC, upon request, copies of records required to be kept by this permit.

G. **Other Information.** When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director or ADEC, it shall promptly submit such facts or information.

H. **Signatory Requirements.** All applications, reports or information submitted to the Director and ADEC shall be signed and certified.

1. All permit applications shall be signed as follows:

   a. For a corporation: by a responsible corporate officer.

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

   c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director or ADEC shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director and ADEC, and

b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. **Changes to authorization.** If an authorization under paragraph IV.H.2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.H.2. must be submitted to the Director and ADEC prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. **Certification.** Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I. Availability of Reports. Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director and ADEC. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

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L. **Severability**. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. **Transfers**. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

N. **State Laws**. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Act.

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Fact Sheet

United States Environmental Protection Agency
Region 10
Park Place Building, 13th Floor
1200 Sixth Avenue, WD-134
Seattle, Washington 98101
(206) 442-1214

Application No.: AK-004685-0 Date: July 15, 1988

PROPOSED ISSUANCE OF A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE POLLUTANTS PURSUANT TO THE PROVISIONS OF THE CLEAN WATER ACT

Tidewater Services Corporation
(Ladd Coal Loading Facility)
Diamond Shamrock Chuitna Coal Joint Venture
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

has applied for a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants pursuant to the provisions of the Clean Water Act. This fact sheet includes (a) the tentative determination of the Environmental Protection Agency (EPA) to issue the permit, (b) information on public comment, public hearing and appeal procedures, (c) the description of the proposed discharge, (d) a listing of tentative effluent limitations, schedules of compliance and other conditions, and (e) a sketch or detailed description of the discharge location. We call your special attention to the technical material presented in the latter part of this document.

Persons wishing to comment on the tentative determinations contained in the proposed permit issuance may do so by the expiration date of the Public Notice. All written comments should be submitted to EPA as described in the Public Comments Section of the attached Public Notice.

After the expiration date of the Public Notice, the Director, Water Division, will make final determinations with respect to the permit issuance. The tentative determinations contained in the draft permit will become final conditions if no substantive comments are received during the Public Notice period.

The permit will become effective 30 days after the final determinations are made, unless a request for an evidentiary hearing is submitted within 30 days after receipt of the final determinations.

The proposed NPDES permit and other related documents are on file, may be inspected, and copies made at the above address any time between 8:30 a.m. and 4:00 p.m., Monday through Friday. Copies and other information may be requested by writing to EPA at the above address to the attention of the Water Permits Section, or by calling (206) 442-1214. This material is also available from the EPA Alaska Operations Office, Room E551, Federal Bldg., 701 C Street, Box 19, Anchorage, Alaska 99513.

TECHNICAL INFORMATION

I. Applicant

Tidewater Services Corporation
Ladd Coal Loading Facility
Diamond Shamrock Chuitna Coal
Joint Venture
550 West 7th Avenue, Suite 1900
Anchorage, Alaska 99501

II. Project Location

Northwest side of Cook Inlet and near the village of Tyonek

III. Project Description

The applicant proposes to develop a coal loading facility with one approach trestle at Ladd on the northwest side of Cook Inlet near the village of Tyonek. A berth will be constructed to support the loading of a barge (up to 20,000 DWT). Initial production capacity will be 2 million short tons per year (MSTPY) and is expected to increase to 5 MSTPY. Trucks will haul coal from the mine to the loading facility at Ladd. Stockpiled coal will then be transferred to barges via conveyor. Stockpiled storage during the initial stage of development will be 400,000 tons. It is expected to increase to 1,200,000 tons as annual throughput is increased.

This facility would be developed in conjunction with a surface coal mine (NPDES Permit Application No. AK-004357-5), housing facilities (NPDES Permit Application No. AK-004356-7), the Granite Point Coal Port (NPDES Permit Application No. AK-004331-1), and a transportation system (no NPDES permit required).

IV. Proposed Discharges

Sanitary waste will be treated by a septic tank and discharged to a leach field. The expected flow is 2000 gpd, serving approximately 40 people. No discharges are expected to enter any surface waters from this operation.

A sedimentation pond will collect equipment washdown water and surface water runoff from the coal storage and surrounding areas. Equipment washdown wastewater will be generated by washing coal dust from the transfer houses, stack-reclaimers, and bulldozers, and from the repair and maintenance shop. The equipment washdown wastewater will be collected and routed through an oil and grease separator before it is routed to the sedimentation pond. The runoff in the pond is primarily storm water and snowmelt runoff collected from the coal storage areas, surrounding areas, and parking lots. This water will be used as make-up water for coal pile spraying, if sufficient, low-cost, suitable water is not available from other sources. The expected total discharge is 298,000 gpd. This source is a "new source" pursuant to the definition of 40 CFR 122.2.

V. Receiving Waters

The outfall line will discharge 2,700 feet offshore to Cook Inlet. Cook Inlet is protected for all uses by the Alaska State Water Quality Standards, including water supply, water recreation, and growth and propagation of fish, shellfish, aquatic life, wildlife including seabirds, waterfowl, and furbearers, and harvesting for consumption of raw mollusks or other raw aquatic life [18 AAC 70.020].

VI. Basis of Permit Limitations

A. The permit limits are based on the "Coal Preparation Plant Associated Area" new source performance standards [40 CFR 434.25(b)]. Even though this loading facility does not include a preparation plant, the surface coal pile runoff is included in the "coal preparation plant associated areas" definition (40 CFR 434.11(f)). These standards limit total iron, total suspended solids (TSS), and pH. Manganese limitations are excluded based on the Final Rule of October 9, 1985, stating that such limitations apply only to preparation plant associated areas that are described as having acid or ferruginous mine drainage (50 F.R. 41296). This mine has alkaline drainage, based on the definition of 40 CFR 434.11.

B. Since the sedimentation pond will be receiving oils and grease from the equipment washdown water, the permit also limits these pollutants. EPA has not promulgated effluent guidelines for this type of wastewater, therefore, the oil and grease limitations in this permit are based on a best professional judgment of applicable technology-based limits for an oil/water separator. The daily average oil and grease limitation is 10 mg/l with a maximum concentration of 15 mg/l.

C. Alternate Effluent Limitations for Precipitation Events

Because solid levels in the discharge cannot be consistently controlled when precipitation events cause increases above baseflow conditions. The Agency promulgated two sets of alternative effluent limitations for periods of precipitation [40 CFR 434.63(a) and (d)]. These limitations become applicable when any discharge (or increase in the volume of the discharge) is caused by precipitation or snowmelt.

The two sets of alternate limitations are for those precipitation events (or snowmelt of equivalent volume) less than or equal to the 10-year, 24-hour precipitation event (40 CFR 434.63(a)(2)); and for those events greater than the 10-year, 24-hour precipitation event (40 CFR 434.63(d)(2)). For this area the 10-year, 24-hour precipitation event is equal to 5.1 inches. Therefore, the two sets of alternate limitations for precipitation events less than or equal to, and greater than 5.1 inches have been included in the permit Part I.A.2.a. and b., respectively.

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The alternate limitations for precipitation events less than or equal to 5.1 inches limit only settleable solids and pH. The other set only limits pH.

The document titled "Supplemental Guidance for the Coal Mining Point Source Category Effluent Limitations Guidelines" (EPA, Office of Water Effluent Guidelines Division, April 1983, draft) clarifies the alternate precipitation limitations. This guidance recommends that because the runoff resulting from precipitation may continue for hours after the precipitation event stops, the alternate effluent limitations should also continue until the area returns to baseflow conditions. This continuation period (or the period after precipitation stops and baseflow conditions are reached) is based on the estimated "time of concentration" for the drainage area and the retention time of the sedimentation pond. These two periods of time are added together to get the length of time the applicable alternate limitations remain in effect once precipitation stops. For this permit, after the precipitation event ceases, the alternate limits remain in effect for another 2 days.

VII. Basis of Monitoring Conditions:

A. Part I.A.1. of the permit includes settleable solids (SS) monitoring. This requirement is included to compare the SS levels with:

1. the TSS levels discharged during baseflow conditions, and
2. the SS levels measured during precipitation events.

This information will also be used to determine any correlation between TSS and SS discharges levels.

B. Self-monitoring of permit parameters is necessary for the permittee to demonstrate compliance with effluent limitations and to assure that State Water Quality Standards are being met. Monitoring frequencies are based on the Agency's determination of the minimum sampling frequency required to adequately monitor the sedimentation pond's performance. Required sample types are based on the Agency's determination of the potential for effluent variability. These determinations take into consideration several factors, of which the most important are the type of pollutants of concern and the type of treatment system.

For this permit relatively infrequent monitoring and grab sampling are required during "Baseflow Conditions" because of the sedimentation pond reduces effluent variability. More frequent monitoring is required, however, during precipitation events to ensure the sedimentation pond is providing adequate treatment for solids removal.

VIII. Other Conditions:

A. Watershed Monitoring Program

The time period of when the alternate limits end and when the baseflow condition limits resume, is based on the "time of concentration" (t_c) and the retention time of the sedimentation pond. The t_c is the time it takes the last of the rainfall from the hydraulically most remote point in the watershed to reach the inlet of the sedimentation pond. The t_c is therefore, dependent on several variables including the soil type, land/vegetative cover, watershed slope, and drainage distance. The t_c can be estimated using empirical methods or measured in the field.

The watershed monitoring program requires the collection of field data to verify the t_c for the watershed area contributing runoff to the sedimentation pond. Field measurements shall be collected four times a year for one year. If the monitoring program results indicate a different t_c for the seasons and/or a significant difference from the estimated t_c, than the permit will be modified to incorporate the field measured t_c.

B. To determine when the alternate limitations apply, precipitation events must be recorded and submitted to EPA and ADEC.

C. Laboratory procedures described in the permit to be followed for the measurement of settleable solids are pursuant to 40 CFR 434.64. Procedures used for other measurements must be in accordance with 40 CFR 136.

D. All of the definitions in Part I.C. of the permit are pursuant to 40 CFR 122 except for "Baseflow Conditions." "Baseflow Conditions", was obtained from the glossary of the document "Surface Coal Mining in Alaska", prepared by the Committee on Alaskan Coal Mining and Reclamation (1980).

E. The permit will expire five years from the effective date of the permit.

Permit No.: AK-004685-0
Application No.: AK-004685-0

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. §1251 et seq.; the "Act"),

Tidewater Services Corporation
(Ladd Coal Loading Facility)
Diamond Shamrock Chuitna Coal Joint Venture

is authorized to discharge from the Ladd coal loading facility located near the village of Tyonek, Alaska, to receiving waters named Cook Inlet, in accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

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Director, Water Division, Region 10
U.S. Environmental Protection Agency

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Specific Limitations and Monitoring Requirements.

During the effective term of this permit, the permittee is authorized to discharge from outfall 001 (sediment pond) in accordance with the following:

1. Baseflow Conditions

Discharges shall comply with the following limitations and monitoring requirements during baseflow conditions:

Effluent Characteristics	Effluent Limitations Daily Avg.	Effluent Limitations Daily Max.	Monitoring Requirements Frequency	Monitoring Requirements Sample Type
Oil and Grease	10.0 mg/l	15.0 mg/l	weekly	grab
Total Iron	3.0 mg/l	6.0 mg/l	weekly	grab
Total Suspended Solids (TSS)	35.0 mg/l	70.0 mg/l	weekly	grab
Settleable Solids (SS)	--	--	weekly	grab
pH	Not less than 6.0 standard units, nor greater than 9.0 standard units		weekly	grab
Effluent Flow (mgd)	--	--	daily	instantaneous
Receiving Stream Flow (cfs)	--	--	weekly	instantaneous

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

2. Precipitation Events (Alternate Limitations)

a. Any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to 5.10 inches (or snowmelt of equivalent depth) shall comply with the following limitations and monitoring requirements:

Effluent Characteristics	Effluent Limitations Daily Maximum	Monitoring Requirements Frequency	Monitoring Requirements Sample Type
Effluent Flow (mgd)	N/A	daily	instantaneous
Receiving Stream Flow (cfs)	N/A	daily	instantaneous
SS	0.5 ml/l	daily	grab
pH	not less than 6.0 standard units, nor greater than 9.0 standard units.	daily	grab

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

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b. Any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than 5.10 inches (or snowmelt of equivalent depth) shall comply with the following limitations and monitoring requirements:

Effluent	Effluent Limitations	Monitoring Requirements	
Characteristics	Daily Maximum	Frequency	Sample Type
Effluent Flow (mgd)	N/A	daily	instantaneous
Receiving Stream Flow (cfs)	N/A	daily	instantaneous
pH	not less than 6.0 standard units, nor greater than 9.0 standard units.	daily	grab

There shall be no discharge of floating solids, visible foam in other than trace amounts, or oil or grease which causes a sheen on the surface of the receiving water.

c. The alternate precipitation limitations and monitoring requirements in Parts I.A.2.a. or b. begin when a discharge (or an increase in the volume of a discharge) is caused by precipitation (or snowmelt of equivalent depth), and shall continue two days following cessation of the precipitation event.

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B. Other Permit Requirements.

1. Watershed Monitoring Program

A monitoring program shall be established in order to define relationships between soil type, vegetation, and precipitation runoff, and the rate and quality of discharge from settling ponds for the four seasons of the year. The resulting watershed hydrographs should provide documentation for determining the "time of concentration" of the area contributing runoff to the sedimentation pond. The "time of concentration" is the time it takes for the last of the runoff from the hydraulically most remote point in the drainage area to reach the inlet of sedimentation pond. The program shall include provisions for monitoring influent to the sedimentation pond and precipitation.

The permittee shall submit details of this program to EPA and the Alaska Department of Environmental Conservation for review and approval within 90 days of the effective date of this permit.

2. Precipitation Monitoring Program

The permittee shall keep a record of all precipitation events. This record shall include as a minimum dates, time, and precipitation amounts for each precipitation event. A copy of this record shall be submitted with the monthly discharge monitoring reports (DMR) see Part II.C.

3. Sanitary Waste

The discharge of sanitary waste from the Ladd Coal Loading Facility to any waters of the United States is not authorized.

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C. **Definitions.**

1. **"Average monthly discharge limitation"** means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

2. **"Maximum daily discharge limitation"** means the highest allowable "daily discharge."

3. **"Daily discharge"** means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

4. A **"Grab"** sample is a single sample or measurement taken at a specific time or over as short a period of time as is feasible.

5. **"Upset"** means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

6. **"Bypass"** means the intentional diversion of waste streams from any portion of a treatment facility.

7. **"Severe property damage"** means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

8. **"Baseflow Conditions"** refers to the sustained flow of water in rivers and streams resulting primarily from groundwater seepage into the water courses.

9. **"Precipitation Event"** includes any period of time for which there has been measurable precipitation, and periods of snowmelt (occurring at any time there is snow on the ground within the watershed and the temperature is above 0°C).

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II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. **Representative Sampling**. Samples taken in compliance with the monitoring requirements established under Part I shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. **Monitoring Procedures.**

1. **Settleable Solids**. Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating material occurs, do not include the floating material in the reading.

2. **Other Parameters**. Monitoring for other parameters must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

C. **Reporting of Monitoring Results**. Monitoring results shall be summarized each month on the Discharge Monitoring Report (DMR) form (EPA No. 3320-1). The reports shall be submitted monthly and are to be postmarked by the 10th day of the following month. Legible copies of these, and all other reports, shall be signed and certified in accordance with the requirements of **Part IV.H., Signatory Requirements**, and submitted to the Director, Water Division and the State agency at the following addresses:

original to: United States Environmental Protection Agency (EPA)
Region 10
1200 Sixth Avenue, WD-135
Seattle, Washington 98101

copy to: Alaska Department of Environmental Conservation (ADEC)
Southcentral Region
3601 "C" Street, Suite 1350
Anchorage, Alaska 99503

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D. **Additional Monitoring by the Permittee.** If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

E. **Records Contents.** Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

F. **Retention of Records.** The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director or ADEC at any time. Data collected on-site, copies of Discharge Monitoring Reports, and a copy of this NPDES permit must be maintained on-site during the duration of activity at the permitted location.

G. **Twenty-four Hour Notice of Noncompliance Reporting.**

1. The following occurrences of noncompliance shall be reported by telephone within 24 hours from the time the permittee becomes aware of the circumstances:

    a. Any noncompliance which may endanger health or the environment;

    b. Any unanticipated bypass which exceeds any effluent limitation in the permit **(See Part III.G., Bypass of Treatment Facilities.)**;

    c. Any upset which exceeds any effluent limitation in the permit **(See Part III.H., Upset Conditions.)**; or

    d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit to be reported within 24 hours.

2. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

    a. A description of the noncompliance and its cause;

    b. The period of noncompliance, including exact dates and times;

    c. The estimated time noncompliance is expected to continue if it has not been corrected; and

    d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Water Compliance Section in Seattle, Washington, by phone, (206) 442-1213.

4. Reports shall be submitted to the addresses in **Part II.C., Reporting of Monitoring Results**.

H. **Other Noncompliance Reporting**. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.C. are submitted. The reports shall contain the information listed in Part II.G.2.

I. **Inspection and Entry**. The permittee shall allow the Director, ADEC, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

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III. COMPLIANCE RESPONSIBILITIES

A. **Duty to Comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. **Penalties for Violations of Permit Conditions.**

1. **Civil Penalty.** The Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be subject to a civil penalty, not to exceed $25,000 per day for each violation.

2. **Criminal Penalties:**

   a. **Negligent Violations.** The Act provides that any person who negligently violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or by both.

   b. **Knowing Violations.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be punished by a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or by both.

   c. **Knowing Endangerment.** The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. A person which is an organization shall, upon conviction of violating this subparagraph, be subject to a fine of not more than $1,000,000.

   d. **False Statements.** The Act provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more that $10,000, or by imprisonment for not more than 2 years, or by both.

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Except as provided in permit conditions in **Part III.G., Bypass of Treatment Facilities** and **Part III.H., Upset Conditions,** nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. **Need to Halt or Reduce Activity not a Defense**. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. **Duty to Mitigate**. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. **Proper Operation and Maintenance**. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. **Removed Substances**. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

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G. Bypass of Treatment Facilities:

1. **Bypass not exceeding limitations.** The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this section.

2. **Notice:**

    a. **Anticipated bypass.** If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 10 days before the date of the bypass.

    b. **Unanticipated bypass.** The permittee shall submit notice of an unanticipated bypass as required under **Part II.G., Twenty-four Hour Notice of Noncompliance Reporting**.

3. **Prohibition of bypass.**

    a. Bypass is prohibited and the Director or ADEC may take enforcement action against a permittee for a bypass, unless:

        (1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

        (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

        (3) The permittee submitted notices as required under paragraph 2 of this section.

    b. The Director and ADEC may approve an anticipated bypass, after considering its adverse effects, if the Director and ADEC determine that it will meet the three conditions listed above in paragraph 3.a. of this section.

H. Upset Conditions.

1. **Effect of an upset.** An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph 2 of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. **Conditions necessary for a demonstration of upset.** A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated;

   c. The permittee submitted notice of the upset as required under **Part II.G., Twenty-four Hour Notice of Noncompliance Reporting**; and

   d. The permittee complied with any remedial measures required under **Part III.D., Duty to Mitigate**.

3. **Burden of proof.** In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

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IV. GENERAL REQUIREMENTS

A. **Changes in Discharge of Toxic Substances.** Notification shall be provided to the Director and ADEC as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. One hundred micrograms per liter (100 ug/l);

   b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

   c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

   d. The level established by the Director in accordance with 40 CFR 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. Five hundred micrograms per liter (500 ug/l);

   b. One milligram per liter (1 mg/l) for antimony;

   c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

   d. The level established by the Director in accordance with 40 CFR 122.44(f).

B. **Planned Changes.** The permittee shall give notice to the Director and ADEC as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR 122.29(b); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under Part IV.A.1.

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C. **Anticipated Noncompliance.** The permittee shall also give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

D. **Permit Actions.** This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

E. **Duty to Reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit.

F. **Duty to Provide Information.** The permittee shall furnish to the Director and ADEC, within a reasonable time, any information which the Director or ADEC may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director or ADEC, upon request, copies of records required to be kept by this permit.

G. **Other Information.** When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director or ADEC, it shall promptly submit such facts or information.

H. **Signatory Requirements.** All applications, reports or information submitted to the Director and ADEC shall be signed and certified.

1. All permit applications shall be signed as follows:

    a. For a corporation: by a responsible corporate officer.

    b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

    c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director or ADEC shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

    a. The authorization is made in writing by a person described above and submitted to the Director and ADEC, and

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b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. **Changes to authorization.** If an authorization under paragraph IV.H.2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.H.2. must be submitted to the Director and ADEC prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. **Certification.** Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I. **Availability of Reports.** Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director and ADEC. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

J. **Oil and Hazardous Substance Liability.** Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

K. **Property Rights.** The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

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L. Severability. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

N. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Act.

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AIR QUALITY EMISSIONS
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ATTACHMENT A - State of Alaska Department of Environmental Conservation

ATTACHMENT B - (Excerpt from: California Air Resources Board, 1983.
Draft Report to the California Legislature on Air
Pollutant Emissions from Marine Vessels).

APPENDIX E
AIR QUALITY EMISSIONS

1.0 INTRODUCTION

This appendix contains calculations of significant air emissions associated with the project. It includes construction and temporary (overland truck haul) emissions, and short-term and annual average production-phase emissions.

Production phase emissions, where feasible, are assigned to one of the four functional areas of the project; the mine area, the service area, the port facility, or the housing facility. Emissions which occur between the four functional areas, such as overland conveyor emissions and miscellaneous vehicle emissions, are listed separately.

Production-phase emissions are calculated for both production year 3 and full production emissions. Full production corresponds to the fourth year of production. Emissions estimates for both years were fairly close because though year 3 would have half the coal production of year 4, a significantly higher amount of overburden would be moved in year 3. Therefore, emissions for both years were estimated and modeled. Where production emissions show only one annual rate, emissions would be approximately the same at both production levels.

Emission factors, except where noted, are calculated from State of Alaska Department of Environmental Conservation emission factor equations for surface mines (Attachment A). Original sources for the Attachment A equations are also indicated below where appropriate.

2.0 CONSTRUCTION-RELATED AND TEMPORARY EMISSIONS

Construction-related emissions include the land clearing and slash burning emissions which would occur during the first three years of the project, prior to coal production. Temporary emissions include the emissions from the overland coal haul by truck to the port site. This will occur only during the first two years of coal production, while the conveyor is being constructed. These overland truck haul emissions are of concern because the emissions will be significantly higher than the emissions from the conveyor.

2.1 Construction Land Clearing Fugitive Dust Emissions

Emission Factor = $5.7\ s^{1.2}/M^{1.3}$ lb/hr (1)
Source: U.S. EPA 1985, Section 8.24

where s = silt content of overburden = 31%
M = moisture content of overburden = 45%

$$EF = 5.7(31)^{1.2}/(45)^{1.3} = 2.49 \text{ lb/hr}$$

Emissions:
Annual
PM = (2.49 lb/hr)(44,548 hr/yr)[a]
= 55.5 ton/yr

2.2 Construction Land Clearing Dozer Tailpipe Emissions

Emission Factors

NO_x: 4.166 lb/hr
SO_2: 0.348 lb/hr
CO: 1.794 lb/hr
VOC: 0.192 lb/hr
PM: 0.165 lb/hr

Source: U.S. EPA 1985, Table II-7.1

Emissions:

Annual
NO_x = (4.166 lb/hr)(44,548 hr/yr)[a]
= 92.8 ton/yr

Emissions of the other pollutants are calculated in the same manner.

2.3 Construction Slash Burning Emissions

Emission Factors:

NO_x: 64 lb/acre
SO_2: 0 Ib/acre
CO: 2235 lb/acre
HC: 384 lb/acre
PM: 272 lb/acre

ADEC Emission Factor. Source: U.S. EPA 1985, Section 11.1.

Emissions:
Annual
PM = (272 lb/acre)(150 acres/year)(ton/2000 lb)
= 20.4 ton/yr

Emissions of the other pollutants are calculated likewise using the emission factors given above.

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[a] Letter from TRC to Dan Harlow (Diamond Alaska Coal Co.), March 17, 1988

2.4 Temporary Overland Truck Coal Haul Fugitive Dust Emissions

ADEC Emission Factor. Source: U.S. EPA 1985, Section 8.24.

Emission Factor = $0.0067w^{3.4}L^{0.2}$ (2)

where w = number of wheels = 6
L = road surface silt loading = 40.8 g/m^2

$$EF = (0.0067)(6)^{3.4}(40.8)^{0.2}$$
$$= 6.22 \text{ lb/VMT}$$

Control: Emissions would be 85% controlled through a program of chemical dust supressant application and watering.

Emissions:
Annual
PM = (6.22 lb/VMT)(99 trips/day)(22 mi/trip)
(338 day/yr)(1-0.85 control)(ton/2000 lb)
= 343 ton/yr

2.5 Temporary Truck Coal Haul Exhaust Emissions

Assume 1000 hp engines and a vehicle speed of 30 mph.

Emission Factors:

NO_x:	8.15 g/hphr
SO_2:	0.887 g/hphr
CO:	2.28 g/hphr
HC:	0.37 g/hphr
PM:	0.502 g/hphr

Source: U.S. EPA 1985, Table II-7.1

Emissions:
Annual
NO_x = (8.15 g/hphr)(1000 hp)(hr/30 mi)(99 trips/day)(22 mi/trip)(338 day/yr)(lb/454 g)
(ton/2000 lb)
= 220.3 ton/yr

Emissions of the other pollutants are calculated in the same manner using the emission factors given above. All HC emissions are assumed to be VOCS.

3.0 MINE AREA EMISSIONS

Emissions in the mine area would include those associated with land clearing and slash burning, overburden removal, coal removal, overburden replacement, and reclamation activities.

3.1 Land Clearing/Reclamation

This includes reclamation and land clearing emissions from bulldozer work. Emissions are the same as those calculated for construction (Section 2.1).

Emissions:

Annual

$$2.49 \text{ lb/hr} \times \frac{44{,}548 \text{ hr}}{\text{yr}} \times \frac{\text{ton}}{2{,}000 \text{lb}} = 55.5 \text{ ton/yr}$$

PM = 55.5 ton/yr

Hourly

$$\text{PM} = \frac{55.5 \text{ ton}}{\text{yr}} \times \frac{2{,}000 \text{ lb}}{\text{ton}} \times \frac{\text{yr}}{338 \text{ days}} \times \frac{1 \text{ day}}{24\text{hr}} = 13.7 \text{ lb/hr}$$

3.2 Slash Burning Emissions

Emissions are the same as those calculated for construction (Section 2.3). Slash burning would not occur simultaneously with most of the other activities and acreage involved in a single burn session is unknown. Therefore, hourly slash burn emissions are not quantified.

Annual PM = 20.4 ton/yr

3.3 Overburden Removal - Truck Shovel

$$\text{Emission Factor} = \frac{0.0018k(s/5)(u/5)(d/5)}{(M/2)^2(Y/6)^{0.33}} \text{ lb/ton} \quad (3)$$

ADEC Emission Factor. Source: U.S. EPA 1985, Section 11.2.3.3.

where k = particle size factor = 0.73
s = silt content of overburden = 31%
u = annual average wind speed = 5.6 mph
d = drop distance into trucks = 5 feet
M = moisture content of overburden = 45%
Y = batch size of shovels = 22.3 yd^3

$$\text{EF} = \frac{(0.0018)(0.73)(31/5)(5.6/5)(5/5)}{(45/2)^2\ (22.3/6)^{0.33}}$$

$$= 1.17 \times 10^{-5} \text{ lb/ton}$$

Emissions:

Annual, production year 3

$$PM = (1.17 \times 10^{-5} \text{ lb/ton})(17.481 \times 10^6 \text{ ton/yr})(\text{ton/2000 lb}) = 0.1 \text{ ton/yr}$$

Annual, full production

$$PM = (1.17 \times 10^{-5} \text{ lb/ton})(17.186 \times 10^6 \text{ ton/yr})(\text{ton/2000 lb}) = 0.1 \text{ ton/yr}$$

Hourly

$$PM = (2.49 \text{ lb/hr})(11 \text{ dozers})(13.3 \text{ hr/day})(\text{day/24 hr})(2000 \text{ lb/ton}) = 0.02 \text{ lb/hr}$$

Note that overburden movement and coal movement constitute the entire material movement scenario at the mine. There are no additional catagories of material (such as topsoil) to be handled.

3.4 Overburden Removal - Dragline

Emission factor = (0.04)(0.75)(365-n)/365 (4)

ADEC Emission Factor. Source: U.S. EPA 1978.

where n = number of wet days per year = 100

$$EF = 0.02178 \text{ lb/yd}^3$$

Emissions:

Annual, production year 3

$$PM = (0.02178 \text{ lb/yd}^3)(15.151 \times 10^6 \text{ yd}^3\text{/yr})(\text{ton/2000 lb}) = 165.0 \text{ ton/yr}$$

Hourly, production year 3

$$PM = (165.0 \text{ ton/yr})(\text{yr/365 day})(\text{day/24 hr})(2000 \text{ lb/ton}) = 37.7 \text{ lb/hr}$$

Annual, full production

$$PM = (0.02178 \text{ lb/yd}^3)(20.327 \times 10^6 \text{ yd}^3\text{/yr})(\text{ton/2000 lb}) = 221.4 \text{ ton/yr}$$

Hourly, full production

$$PM = (221.4 \text{ ton/yr})(\text{yr/365 day})(\text{day/24 hr})(2000 \text{ lb/ton}) = 50.6 \text{ lb/hr}$$

3.5 Overburden Hauling

Emission Factor = 6.22 lb/VMT (see Section 2.4)

Control: 85% control with application of chemicals.

Emissions:

Annual, production year 3

PM = (6.22 lb/VMT)(483,645 VMT/yr)(1-0.85 control)(ton/2000 lb)
= 225.6 ton/yr

Annual, full production

PM = (6.22 lb/VMT)(134,837 VMT/yr)(1-0.85 control)(ton/2000 lb)
= 62.9 ton/yr

Hourly, production year 3

PM = (225.6 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 51.5 lb/hr

Hourly, full production

PM = (62.9 ton/yr)(hr/365 day)(day/24 hr)(2000 lb/ton)
= 14.4 lb/hr

3.6 Overburden Dumping

Emission Factor - See Section 3.3.

where k = 0.73, s = 31%, u = 5.6 mph, M = 45%
d = drop distance to ground = 6 feet
Y = batch size of trucks = 96.9 yd^3

$$EF = \frac{(0.0018)(0.73)(31/5)(5.6/5)(6/5)}{(45/2)^2\ (96.9/6)^{0.33}}$$

$$= 8.64 \times 10^{-6} \text{ lb/ton}$$

Emissions:

Annual, production year 3

PM = (8.64 x 10^{-6} lb/ton)(30.679 x 10^6 ton/yr)(ton/2000 lb)
= 0.1 ton/yr

Annual, full production

PM = (8.64 x 10^{-5} lb/ton)(30.161 x 10^6 ton/yr)(ton/2000 lb)
= 0.1 ton/yr

Hourly

PM = (0.1 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 2.3 x 10^{-2} lb/hr

3.7 Coal Removal

Emission Factor = 0.003 x 0.70 lb/ton
= 2.1×10^{-3} lb/ton

ADEC Emission Factor. Source: U.S. EPA 1978. Note that this emission factor is also used by the State of Wyoming Division of Air Quality.

Emissions:

Annual, production year 3
PM = $(2.1 \times 10^{-3}$ lb/ton)$(6 \times 10^{6}$ ton/yr) (ton/2000 lb)
= 6.3 ton/yr

Annual, full production
PM = $(2.1 \times 10^{-3}$ lb/ton)$(12 \times 10^{6}$ ton/yr) (ton/2000 lb)
= 12.6 ton/yr

Hourly, production year 3
PM = (6.3 ton/yr)(yr/365 day)(day/24 hr) (2000 lb/ton)
= 1.4 lb/hr

Hourly, fully production
PM = (12.6 ton/yr)(yr/365 day)(day/24 hr) (2000 lb/ton)
= 2.9 lb/hr

3.8 Coal Hauling

Emission Factor = 6.22 lb/VMT (see Section 2.4)

Control: 85% with application of chemicals.
Emissions:

Annual, production year 3
PM = (6.22 lb/VMT)(93,529 VMT/yr)(1-0.85 control)(ton/2000 lb)
= 43.6 ton/yr

Annual, full production
PM = (6.22 lb/VMT)(187,059 VMT/yr)(1-0.85 control)(ton/2000 lb)
= 87.3 ton/yr

Hourly, production year 3
PM = (43.6 ton/yr)(yr/365 day)(day/24 hr) (2000 lb/ton)
= 10.0 lb/hr

Hourly, full production
PM = (87.3 ton/yr(yr/365 day)(day/24 hr) (2000 lb/ton)
= 19.9 lb/hr

3.9 Coal Dumping

Emission Factor = (See Section 3.3)

where $k = 0.73$, $u = 5.6$ mph
s = silt content of coal = 6.2%
d = drop distance into hopper = 6 feet
M = moisture content of coal = 28%
Y = batch size of trucks = 96.9 yd^3

$$EF = \frac{(0.0018)(0.73)(6.2/5)(5.6/5)(6/5)}{(28/2)^2\ (96.9/6)^{0.33}}$$

$$= 4.46 \times 10^{-6} \text{ lb/ton}$$

Emissions:

Annual, production year 3
$PM = (4.46 \times 10^{-6}$ lb/ton)(6 x 10^6 ton/yr)
(ton/2000 lb)
= 0.01 ton/yr

Annual, full production
$PM = (4.46 \times 10^{-6}$ lb/ton)(12 x 10^6 ton/yr)
(ton/2000 lb)
= 0.03 ton/yr

Hourly, production year 3
PM = (0.01 ton/yr)(yr/365 day)(day/24 hr)
(2000 lb/ton)
= 2.3×10^{-3} lb/hr

Hourly, full production
PM = (0.03 ton/yr)(yr/365 day)(day/24 hr)
(2000 lb/ton)
= 6.8×10^{-3} lb/hr

3.10 Coal Primary Crushing

Emission Factor = 0.02 lb/ton

ADEC Emission Factor. Source: U.S. EPA 1985, Section 8.23

Control: 99% with baghouse.

Emissions:

Annual, production year 3
PM = (0.02 lb/ton)(6 x 10^6 ton/yr)(1-0.99 control)(ton/2000 lb)
= 0.6 ton/yr

Annual, full production
PM = (0.02 lb/ton)(12 x 10^6 ton/yr)(1-0.99 control)(ton/2000 lb)
= 1.2 ton/yr

(2000 lb/ton)
= 0.1 lb/hr

Hourly, full production
PM = (1.2 ton/yr)(yr/365day)(day/24 hr)(2000 lb/ton)
= 0.3 lb/hr

3.11 Wind Erosion - Mine Area

Emission Factor = aICKL'V' ton/acre-yr

ADEC Emission Factor. Source: U.S. EPA 1978.

where a = suspended fraction = 0.025
I = soil erodibility = 47 ton/acre-yr
C = Climatic factor = 0.1
K = Roughness factor = 0.7
L'= Unsheltered field width factor = 0.7
V'= Vegetation Factor = 1.0

Emission Factor = (0.025)(47)(0.1)(0.7)(0.7(1.)
= 0.576 ton/acre-yr

Disturbed area = mined area-reclaimed area
= 746 acres - 85 acres
= 661 acres (year 6)

Emissions:

Annual, production year 3
PM = (0.0576 ton/acre-yr)(661 acres)
= 38.0 ton/yr

Annual, full production
PM = (0.0576 ton/acre-yr)(1054 acres - 430 acres)
= 35.9 ton/yr

Hourly, production year 3
PM = (3.8 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 8.7 lb/hr

Hourly, full production
PM = (35.9 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 8.2 lb/hr

3.12 Haul Road Maintenance/Graders

Emission factor = $0.04s^{2.5}$ lb/VMT

Source: U.S. EPA 1985, Section 8.24

where s = grader speed = 4 mph

EF = $(0.04)(4)^{2.5}$
= 1.28 lb/VMT

Control: 50 percent with watering

Emissions:
Annual
PM = (1.28 lb/VMT)(2 graders)(18 hr/day)
(4 mi/hr) x (338 day/yr)(ton/2000
lb)(1-0.50)
= 15.6 ton/yr

Hourly
PM = (1.28 lb/VMT)(2 graders)(4 mi/hr)
(1-0.50)
= 5.1 lb/hr

3.13 Dozer Tailpipe Emissions

Emissions are the same as those calculated for construction (Section 2.2).

Hourly
NO_x = (4.166 lb/hr)(44,548 hr/yr)(yr/338 days)
(day/24 hr)
= 22.9 lb/hr

Emissions of the other pollutants are calculated in the same manner.

3.14 Grader Tailpipe Emissions

Emission Factors:

NO_x: 0.713 lb/hr
SO_2: 0.086 lb/hr
CO: 0.151 lb/hr
VOC: 0.040 lb/hr
PM: 0.061 lb/hr

Source: U.S. EPA 1985, Table II-7.1

Emissions:
Annual
NO_x = (0.713 lb/hr)(2 graders)(18 hr/day)
(338 day/yr)(ton/2000 lb)
= 4.3 ton/yr

Annual emissions of the other pollutants are calculated in the same manner.

Grader Tailpipe	NO_x	SO_2	CO	VOC	PM
Annual Emissions (tons/yr)	4.3	0.5	0.9	0.2	0.4

Hourly
NO_x = (0.713 lb/hr)(2 graders)
= 1.4 lb/hr

3.15 Haul Truck Tailpipe Emissions

Emission factors: See Section 2.5.

Emissions:
Annual, production year 3
NO_x = (8.15 g/hphr)(1000 hp)(hr/30 mi)(93,529 VMT/yr)(lb/454 g)(ton/2000 lb)
= 28.0 ton/yr

Annual, full production
NO_x = (8.15 g/hphr)(1000 hp)(hr/30 mi)(187,059 VMT/yr)91b/454 g)(ton/2000 lb)
= 56.0 ton/yr

Hourly, production year 3
NO_x = (28.0 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 6.4 lb/hr

Hourly, full production
NO_x = (56.0 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 12.8 lb/hr

Emission of the other pollutants are calculated in the same manner with the emission factors listed above. All HC emissions are assumed to be VOCs.

Haul Trucks: (Overburden)

Emissions:
Annual, production year 3
NO_x = (8.15 g/hphr) (1000 hp) (hr/30 mi) (483,645 VMT/yr) (lb/454 g) (ton/2000 lb)
= 144.8 ton/yr

Annual, full production
NO_x = (8.15 g/hphr)(1000 hp)(hr/30 mi) (134,837 VMT/yr)(lb/454 g)(ton/2000 lb)
= 40.3 ton/yr

Hourly, production year 3
NO_x = (144.8 ton/yr)(yr/365 day)(day/24 hr) (2000 lb/ton)
= 33.1 lb/hr

Hourly, full production
NO_x = (40.3 ton/yr)(yr/365 day)(day/24 hr)
(2000 lb/ton)
= 9.2 lb/hr

Note: Vehicle miles travelled for coal and overburden are found in Table 4 of "Response to Comments by ADEC Regarding the Diamond Chuitna Project Air Quality Impact Analysis", April 20, 1987.

3.16 Other Mine Area Sources

Other potential sources of emissions in the mine area are the permanent landfill and secondary blasting. Blasting will not be required for removal of the coal or the overburden. Blasting would only be required occasionally when large boulders are encountered. Activities at the permanent landfill would also be intermittent. Because the emissions from these sources would occur intermittently and because they are not expected to be substantial, they are not quantified.

4.0 MINE SERVICE AREA EMISSIONS

Emissions in the mine service area include those associated with coal handling, processing, and storage.

4.1 Secondary Coal Crushing

Emission Factor = 0.06 lb/ton

Source: PEDCo 1976. This emission factor is somewhat higher than the ADEC emission factor of 0.05 lb/ton for secondary crushing, as given in AP-42 Section 8.23. However, the 0.06 lb/ton reflects the emissions as modeled.

Control: 99% with baghouse.

Emissions:
Annual, production year 3
PM = (0.06 lb/ton)(6 x 10^6 ton/yr)(1-0.99
control)(ton/2000 lb)
= 1.8 ton/yr

Annual, full production
PM = (0.06 lb/ton)(12 x 10^6 ton/yr)(1-0.99
control)(day/24 hr)(ton/2000 lb)
= 3.6 ton/yr

Hourly, production year 3
PM = (1.8 ton/yr)(yr/365 day)(day/24 hr)(2000

lb/ton)
= 0.4 lb/hr

Hourly, full production
PM = (3.6 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 0.8 lb/hr

4.2 Coal Screening

Emission Factor = 0.10 lb/ton (PEDCo 1976)

Control: 99% with baghouse.

Emissions:

Annual, production year 3
PM = (0.10 lb/ton)(6 x 10^6 ton/yr)(1-0.99 control)(day/24 hr)(ton/2000 lb)
= 3.0 ton/yr

Annual, full production
PM = (0.10 lb/ton)(12 x 10^6 ton/yr)(1-0.99 control)(day/24 hr) (ton/2000 lb)
= 6.0 ton/yr

Hourly, production year 3
PM = (3.6 ton/yr0(yr/365 day)(day/24 hr)(2000 lb/ton)
= 0.7 lb/hr

4.3 Coal Handling At Mine Services Area

There are two main coal transfer points in the mine services area; the transfer/weight stations and the surge pile. A control factor of 90% is assumed for enclosure.

$$\text{Emission Factor} = \frac{0.0018k(s/5)(u/5)(d/10)}{(M/2)^2}$$

Source: U.S. EPA 1985, Section 8.24

where k = particle size multiplier = 0.77
s = silt content of coal = 6.2%
u = annual average wind speed = 5.6 mph
d = drop distance for the conveyor system 10 feet
M = moisture content of the coal = 28%

$$EF = (0.0018)(0.77)(6.2/5)(5.6/5)(10/10)/(28/2)^2$$
$$= 1.0 \times 10^{-5} \text{ lb/ton}$$

Emissions:

Annual, production year 3
PM = (1.0 x 10^{-5} lb/ton)(6 x 10^6 ton/yr)(1-0.90 control) x (ton/2000 lb)(2 transfers)
= 0.006 ton/yr

Annual, full production
PM = (1.0 x 10^{-5} lb/ton)(12 x 10^{6} ton/yr)
(1-0.90 control) x (ton/2000 lb)(2 transfers)
= 0.012 ton/yr

Hourly, production year 3
PM = (0.006 ton/yr)(yr/365 day)(day/24 hr)
(2000 lb/ton)
= 0.00 lb/hr

Hourly, full production
PM = (0.012 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 0.00 lb/hr

The mine services area coal handling emissions analysis above was based on a preliminary simplified description of the coal handling system. A more detailed analysis, too lengthy to include, revealed that the emissions would be less than those presented here. The major assumptions of this detailed analysis were: 99% control with a baghouse on splitter hopper, secondary crusher, and associated drop points; 90% control with enclosure for the transfer stations and surge pile and 20% of coal volume circulated through surge pile.

4.4 Coal Stockpile

Emission Factor = 1.6 u lb/acre-hr

ADEC Emission Factor. Source: U.S. EPA 1985, Section 8.24.

where u = wind speed = 2.5 m/s

EF = (1.6)(2.5)
= 4.0 lb/acre-hr

Control: 50% with watering.

Emissions:
Annual
PM = (4.0 lb/acre/hr)(2.35 acre)(8760 hr/yr)
(ton/2000 lb) (1-0.50 control)
= 20.5 ton/yr

Hourly
PM = (4.0 lb/acre/hr)(2.35 acre)(8760 hr/yr)
(1-0.50 control)

= 4.7 lb/hr

4.5 Wind Erosion - Mine Service Facilities Area

Emission Factor = 0.0576 ton/acre-yr (see Section 3.11)

Emissions:

Annual

PM = (0.0576 ton/acre-yr)(173 acres)
= 10.0 ton/yr

Hourly

PM = (10.0 ton/yr)(yr/365 day)(day/24 hr)
(2000 lb/ton)
= 2.3 lb/hr

5.0 PORT FACILITY EMISSIONS

Emissions at the port facility would be associated with coal handling and storage, and coal and supply ship emissions.

5.1 Coal Handling at Port Facility

Eight main coal transfer points at the port facility were calculated, including the transfer station, the coal stacker, stockpile retrieval, and the shiploader.

Emission Factor = 1.0×10^{-5} lb/ton (see Section 4.3)

Control: 90% with enclosure.

Emissions:

Annual, production year 3

PM = $(1.0 \times 10^{-5}$ lb/ton)$(6 \times 10^{6}$ ton/yr)(1-0.90 control) (ton/2000 lb) x 8 transfers
= 0.024 ton/yr

Annual, full production

PM = $(1.0 \times 10^{-5}$ lb/ton)$(12 \times 10^{6}$ ton/yr)(1-0.90 control) (ton/2000 lb) x 8 transfers
= 0.048 ton/yr

Hourly, production year 3

PM = (0.024 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 0.005 lb/hr

Hourly, full production

PM = (0.048 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 0.01 lb/hr

The port facility coal handling emissions analysis above was based on a preliminary, simplified description of the coal handling system. A more detailed analysis, too lengthy to include, revealed that the emissions would be less than those presented here. The major assumptions of the detailed analysis were: 99% control with a baghouse on transfer stations #2 and #3; 90% control with enclosure for transfer station #1, the stackers, the shiploader, and conveyor drop points; 5% of coal volume to bypass silo.

5.2 Coal Stockpile at Port Facility

Emission Factor = 4.0 lb/acre-hr (see Section 4.4)

Control: 50% with watersprays and compaction.

Emissions:
Annual
PM = (4.0 lb/acre/hr)(24.9 acres)(1-0.50 control)(8760 hr/yr) (ton/2000 lb)
= 218.1 ton/yr

Hourly
PM = (218.1 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 49.8 lb/hr

5.3 Wind Erosion - Port Facility

Emission Factor = 0.0576 ton/acre-yr (see Section 3.10)

Emissions:
Annual
PM = 0.0576 ton/acre-yr)(206 acres)
= 11.9 ton/yr

Hourly
PM = (11.9 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 2.7 lb/hr

5.4 Coal Ship Emissions

Emissions of the ships while "hoteling" at port, during loading. The ships are assumed to be steamships burning 3% sulfur fuel. Also, the ships are assumed to be of the maximum size, which is approximately 100,000 tons capacity.

Fuel use during hoteling was assumed to be 12% of the full power fuel use of 0.58 lb fuel per ship horsepower hour, for a 21,000 hp vessel (CARB 1983. See Attachment B). Emission factors are based on AP-42 emission factors for steamship while hoteling (U.S. EPA 1985, Table II-3.2).

Emission Factors:

NO_x (as NO_2)	8.0 lb/hr
SO_2 (3% sulfur oil)	103.8 lb/hr
CO	1.1 lb/hr
VOC	0.1 lb/hr
PM	3.5 lb/hr

Emissions:
Annual
NO_x = (8.0 lb/hr)(3760 hr/yr)(ton/2000 lb)
= 15.0 ton/yr

Hourly
NO_x = 8.0 lb/hr

5.5 Fuel Delivery and Storage Emissions

Most of the project's power needs would be supplied through the use of electricity. Diesel fuel and gasoline would be required only for the vehicles and other minor uses. Hydrocarbon emissions from gasoline and diesel storage tanks at the port site and mine site were calculated according to the methodology in AP-42 Section 4.3.2 for fixed roof storage tanks (U.S. EPA 1985). The hydrocarbon emissions consist of vapors from breathing loss (LB) and working loss (LW).

The following parameters were common to all calculations:

Pa = 14.7 psia, Ts = 40°F, T = 41°F, Fp = 1.33, Kc = 1, Kn = 1.0, H = 0.5 h = 10 ft, Mv = 130 for diesel and 66 for gasoline, P = 0.0031 psia for diesel and 3.4 psia for gasoline.

Port site, diesel tanks
2×10^6 gallons diesel stored in two tanks. For each tank, D = 92 ft, H = 0.5 h = 10 ft. Also; C = 1.0, V = 2×10^6, N = 3.0.

LB = 0.64 ton/yr
Lw = 0.03 ton/yr
Lt = Lb + Lw
= 0.67 ton/yr

Port site, gasoline tank
D = 50 ft, H = 10 ft, C = 1, V = 315,000 gal, N = 3.0
LB = 7.90 ton/yr
Lw = 2.54 ton/yr
Lt = Lb + Lw
= 10.44 ton/yr

Mine site, diesel tank
D = 40 ft, H = 10 ft, C = 1, V = 164,000 gal, N = 36.6
LB = 0.08 ton/yr
Lw = 0.03 ton/yr
Lt = Lb + Lw
= 0.11 ton/yr

Mine site, gasoline tank
D = 14 ft, H = 10 ft, C = 0.7, V = 23,600 gal, N = 36.4
LB = 0.61 ton/yr

Lw = 2.32 ton/yr
Lt = Lb + Lw
= 2.93 ton/yr

Thus, total VOC emissions from full storage are 11.1 tons per year at the port site and 3.0 tons per year at the mine site.

5.6 Fuel and Supply Ship Emissions

There is currently no information available on fuel and supply ship schedules and sizes for the project. These ship emissions, therefore, have not been quantified. The main pollutant of concern from the vessels would be SO_2.

SO_2 emissions from the coal ships (Section 5.4) were quantified based on fairly conservative assumptions of 3% sulfur fuel and maximum vessel size. The modeled impacts from these ships were far below the PSD SO_2 increments (see EIS Table 5-21). Therefore, emissions from the fuel and supply ships are not expected to have any significant adverse impact on air quality.

6.0 HOUSING FACILITY EMISSIONS

Two potential sources of emissions at the housing facility would be the incinerator and the airport. The incinerator would burn only general camp refuse (household waste) to reduce the volume of material to be landfilled. The airport would be used to transport workers to and from the site. Approximately two 50 person flights per day would be required. The planes would be emitting for only a short period of time before they reached a level where the pollutants would be rapidly dispersed. Therefore, airport emissions are not quantified. Incinerator emission calculations follow. Note that the steam boiler at the housing facility will be electrically powered.

6.1 Incinerator Emissions

For a worst-case analysis, a peak load of 1000 lb/hr and operation 12 hours per day is assumed.

Emission Factors:

NO_x:	3 lb/ton
HC:	3 lb/ton
CO:	10 lb/ton
SO_2:	2.5 lb/ton
PM:	7 lb/ton

Source: U.S. EPA 1985, Table 2.3-1. Industrial-commercial multiple-chamber incinerator assumed.

Annual emissions:

NO_x = 3 lb NO_x/ton x 0.5 ton/hr x 12 hr/day x 365 day/yr x ton/2000 lb
= 3.3 ton/yr

Hourly

NO_x = (3 lb/ton)(0.5 ton/hr)
= 1.5 lb/hr

Emissions of the other pollutants are calculated likewise using the emission factors listed above.

Incinerator Emissions	NO_x	HC	CO	SO_2	PM
Peak emissions (lb/hr)	1.5	1.5	5	1.25	3.5
Annual emissions (ton/yr)	3.3	3.3	11.0	2.7	7.7

7.0 GENERAL PROJECT AREA EMISSIONS

General project emissions include all emissions which could not be assigned to either the mine area, service area, port facility, or housing area. This includes conveyor emissions and miscellaneous vehicle emissions.

7.1 Overland Conveyor Emissions

Conveyor emissions are typically quantified based on the number of transfer points, rather than the conveyor length, as the majority of emissions result from the coal drop at the transfer points. The overland conveyor is somewhat unusual due to its length (approximately 11 miles). A concerted effort was made to locate an emission factor for the conveyor itself, rather than one related to the transfer points. This included a literature search and contacting conveyor manufacturers. No emission factors based on conveyor length were found. Therefore, for lack of a better factor, therefore, emissions were calculated via an erosion type calculation for coal stockpiles. The exposed area was taken to be the area of the exposed coal on the conveyor belt. The wind speed was taken to be the speed of the conveyor belt. The conveyor belt would be sheltered from crosswinds since it is hooded over the top and one side. This hood would also help capture dust arising from conveyor movement.

The overland conveyor emissions as quantified below are in addition to the conveyor transfer emissions quantified elsewhere. The shorter conveyors at the mine/mine services area and at the port site are typical of the conveyors for which the transfer point emission factors were developed. It would therefore be inappropriate to include a quantification of "wind erosion" emissions for those conveyors.

Emission Factor: 1.6c lb/acre-hr

Source: U.S. EPA 1985, Section 8.24.

where c = the speed of conveyor belt = 5.08 m/sec

Emission Factor = (1.6)(5.08)
= 8.13 lb/acre-hr

Control: 90% for conveyor belt hood

Emissions:

Annual, production year 3

PM = (8.13 lb/acre-hr)(2 ft wide)(55,800 ft long)(acre/43,560 ft^2) x (1-0.90 control)(169 day/yr)(ton/2000 lb)
= 4.2 ton/yr

Annual, full production

PM = (8.13 lb/acre-hr)(2 ft wide)(55,800 ft long)(acre/43,560 ft^2)(1-0.90 control)(338 day/hr)(ton/2000 lb)
= 8.4 ton/yr

Hourly

PM = (8.13 lb/acre-hr)(2 ft wide)(55,800 ft long)(acre/43,560 ft)x (1-0.90 control)
= 2.1 lb/hr

7.2 Miscellaneous Vehicle Traffic Fugitive Dust

Emission Factor = $5.9k(s/12)(S/30)(W/3)^{0.7}(w/4)^{0.5}$ lb/VMT

Source: U.S. EPA 1985, Section 11.2

where k = particle size multiplier = 0.8
s = silt content of road material = 8%
S = vehicle speed = 30 mph
W = vehicle weight = 2 tons
w = number of wheels = 4

$EF = 5.9(0.8)(8/12)(30/30)(2/3)^{0.7}(4/4)^{0.5}$
= 2.37 lb/VMT

Control: 85% control with chemical application.

Emissions:

Annual

PM = (2.37 lb/VMT)(51,000 VMT/yr)(1-0.85 control)(ton/2000)
= 9.1 ton/yr

Hourly

PM = (9.1 ton/yr)(yr/365 day)(day/24 hr)(2000 lb/ton)
= 2.1 lb/hr

7.3 Miscellaneous Vehicle Tailpipe Emissions

Emission Factors:

NO_x: 1.19 g/mi
SO_2: 0.8 g/mi
CO: 13.29 g/mi
VOC: 1.55 g/mi
PM: 0.2 g/mi

Source: NO_x, CO, and TOG are EMFAC7PC emission factors for medium duty trucks, 50% gasoline and 50% diesel. PM estimated from truck emission factors (CARB 1986). SO_2 estimated from Tables II-7.1 and II-7.2 (USEPA 1985).

Emissions:

Annual

NO_x = (1.19 g/mi)(51,000 VMT/yr)(lb/454 g)
(ton/2000 lb)
= 0.067 ton/yr

Hourly

NO_x = (0.067 ton/yr)(yr/365 day)(day/24 hr)
(2000 lb/ton)
= 0.004 lb/hr

Annual and hourly emissions of the other pollutants are calculated likewise, using the above emission factors.

	NO_x	SO_2	CO	VOC	PM
Annual Emissions (tons/yr)	0.067	0.045	0.746	0.087	0.011
Hourly Emissions (lb/hr)	0.004	0.003	0.050	0.006	0.001

7.4 Other Project Sources

Other project components which would be potential sources of air emissions include the sewage treatment plants, water treatment plants, heliport, temporary landfills, and emergency generators. The temporary landfills would only be used for construction materials. The heliport would primarily be used during construction. These minor sources of construction emissions are not quantified. The water treatment plants and sewage treatment plants would be very minor sources of hydrocarbons and possibly particulates. The emergency generator sizes and fuel types have not been specified yet. Therefore, emissions from these sources are not quantified.

8.0 SECONDARY POWER GENERATION EMISSIONS

Power generation emissions are based on projected emissions from a proposed Chugach Electric project to bring a turbine on line as a baseline unit rather than a back-up unit.

9.0 LEVEL 1 VISIBILITY SCREENING ANALYSIS

(See EPA 1980 for a discussion of variables and visibility analyses).

x = distance to nearest Class I area
  = 137 km to Tuxedni National Wildlife Refuge and Wilderness Area
Qpart = particulate mass emission rate
  = (885.2 ton/yr)(yr/338 day)(2000 Mt/2200 ton)
  = 2.38 Mt/day
QNO_x = (186.5 ton/yr)(yr/338 day)(2000 Mt/2200 ton)
  = 0.502 Mt/day
QSO_2 = (216.5 ton/yr)(yr/338 day)(2000 Mt/2200 ton)
  = 0.582 Mt/day

x is greater than 100 km, therefore, $S_z = 100$ m
$p = 2.0 \times 10^8/S_z\ x$
  $= 2.0 \times 10^8/(100\ m)(137\ km) = 1.46 \times 10^4$
rvo = 170 km (highest visibility area)
$Taerosol = (1.06 \times 10^{-5})(170\ km)(2.38 + 1.31\ (0.582)$
  $= 5.66 \times 10^{-3}$

$Tpart = 10(10^{-7})(p)(Qpart)$
  $= 10(10^{-7})(1.46 \times 10^4)(2.38)$
  $= 0.0347$
$TNO_x = 1.7(10^{-7})(p)(QNO_x)$
  $= 1.7\ (10^{-7})(1.46 \times 10^4)(0.502)$
  $= 1.25 \times 10^{-3}$

$C1 = [1.25 \times 10^{-3}/(0.0347 + 1.25 \times 10^{-3})][1 - \exp(-0.0347 - 1.25 \times 10^{-3})]$
  $[\exp(-0.78(137/170)]$
  $= 6.55 \times 10^{-4}$
$C2 = [1 - (1/(C1 + 1)) \exp(- Tpart - TNO_2)][\exp(-1.56\ x/rvo)]$
  $= [1 - (1/(1 + 6.55 \times 10^{-4}) \exp(-0.0347 - 1.25 \times 10^{-3})]$
  $[\exp(-1.56(137/170)]$
  $= 0.0102$
$C3 = 0.368\ [1 - \exp(-Taerosol)]$
  $= 0.368[1 - \exp(-5.66 \times 10^{-3})]$
  $= 2.07 \times 10^{-3}$

Since C1, C2, and C3 are all well below 0.10, there will be no impact of the project on visibility in any Class I area.

10.0 REFERENCES

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ATTACHMENT A

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

FUGITIVE EMISSION FACTORS, SURFACE MINES

SOURCE	EMISSION FACTOR	UNITS
Overburden Removal		
- Truck/Shovel	$\frac{.0018k\ (s/5)(u/5)(d/5)}{(M/2)^2(y/6).33}$	lb/ton
- Scraper, Dozers	32(365-N)/365	lbs/hr
- Dragline	.04x0.75(365-N)/365	lbs/yd^3
Overburden Drilling		
Overburden Blasting	50lbs/blast x 0.75	
Overburden Hauling	.0067w3.4 L0.2 or $5.9k(s/12)(S/30)(W/3)0.7(w/4)0.5\left(\frac{365-N}{365}\right)$	lb/VMT
Overburden Dumping (batch drop)	0.017k	lb/ton
Product Drilling		
Product Blasting	coal: 35 lbs/blast x 0.75	
Product Removal	coal: .003 x 0.70	lbs/ton
Product Hauling	0.0067 w3.4 L0.2 or $5.9k(s/12)(S/30)(W/3)0.7(w/4)0.5\left(\frac{365-N}{365}\right)$	lb/VMT
Reclamation	k 4.8 s0.6	lb/acre
Haulroad Repair/ Construction	32(365-N)/365	lbs/hr
Wind Erosion		
- stripped area	aICKL'V'	tons/acre/yr
- overburden stockpiles	.0756 sf(365-N)/235	lb/day/acre
- wash stockpiles	.0756 sf(365-N)/235	lb/day/acre
- product stockpiles	coal; 1.6u	lbs/acre/hr
- tailings ponds	aICKL'V'	tons/acre/yr

ATTACHMENT A
(continued)

SOURCE	EMISSION FACTOR	UNITS
Product Preparation		
conveyors/transfer points/ truck dump	0.017 x 0.75 (coal)	lb/ton
stackers - raw - surge - fines	$.0018k \frac{(s/5)(u/5)(H/10)}{(M/2)^2}$	lb/ton
Crusing - primary - secondary - tertiary	EPA-AP-42	
Screening	EPA-AP-42	
Graders/compacting on stockpiles	32(365-N)/365	lbs/hr
Load Out/Tipple		
Additional Sources		
Slash Burning	272	lbs/acre
Miscellaneous Road Traffic	$\frac{5.97}{M^4}$	lb/VMT
Ship Traffic	EPA-AP-42	
Fuel Storage	EPA-AP-42	
Incineration	BACT or EPA-AP-42	
Power Generation	BACT or EPA-AP-42	

f: % time - windspeeds >12 mph
N: Nr. days - precip. >0.01 inch/year - table
M: (surface) moisture content - %
L: Surface silt loading (g/m^2)
k: Particle size mulitplier - table
S: Silt content (%) - table
U: Average wind speed (M/S)
H;d: Drop distance (feet)
Y: Batch size (yd^3)
w: Mean number of wheels
W: Mean vehicle weight (tons)

ATTACHMENT A
(continued)

A: Fraction wind erosion losses becoming suspended)
I: Surface erodability)
C: Climatic factor) Tables AP-42
K: Surface roughness factor)
L': Unsheltered field width factor) Use 1.0
V': Vegetation cover factor)

Surface soil type	A	I (tons/acre/yr)
Rocky, gravelly	0.025	38
Sandy	0.010	134
Fine	0.041	52
Clay loam	0.025	47

ATTACHMENT B

(EXCERPT FROM: CALIFORNIA AIR RESOURCES BOARD, 1983. DRAFT REPORT TO THE CALIFORNIA LEGISLATURE ON AIR POLLUTANT EMISSIONS FROM MARINE VESSELS).

3. Factors Affecting Fuel Consumption

For a given fuel sulfur content, emissions of sulfur dioxide are directly related to a vessel's fuel consumption rate. The fuel consumption rate in turn depends on the size (shaft horsepower or SHP) and the type (diesel, steam turbine, gas turbine) of the powerplant used to drive a vessel and on the amount of power used to perform various operations. A 14,000 deadweight ton (DWT) general freighter would consume fuel at a rate of about 60 tons per day while a 70,000 DWT tanker would consume about 110 tons per day of fuel at cruising speed. Those vessels are of a size that typically visit California Coastal Waters. Marine diesel engines burn 0.28 to 0.44 pound of fuel per SHP hour and marine steam engines burn 0.51 to 0.65 pound per SHP hour.8/

a. Ship Powerplant Size

The power required of a ship's powerplant is a function of the size of the ship and the speed at which the ship is intended to operate. Tankers and bulk carriers are designed to carry large loads, and a high speed is not essential to their operation. Maximum cruising speeds for these types of vessels are generally in the range of 16 knots.9/ Modern passenger and container-carrying ships, on the other hand, operate at speeds of 20 to 25 knots.10/ Container vessels carry cargoes that have high worth to weight ratios, are perishable, or for other reasons must be delivered rapidly. Thus for the same tonnage of cargo carrying capacity, bulk carriers and tankers have smaller powerplants than container ships, general cargo carriers, and other specialized types of dry cargo vessels. Military vessels usually have at least three to four times the total shaft horsepower of commercial vessels of equivalent size.[11/]

Power requirements for commercial vessels typically range from about 9,000 SHP for a 12,000 DWT vessel to about 45,000 SHP for an LNG carrier.* Typical horsepower requirements for tankers are shown in Table VII-4. As the table shows, the maximum power requirement for a tanker is approximately 65,000 SHP. However, tankers larger than about 280,000 DWT do not visit California Coastal Waters. Typical maximum power requirements for other types of ships are shown in Table VII-5. As Table VII-5 shows, container ships can have much larger powerplants than either tankers or bulk carriers.

Table VII-6 shows the average shaft horsepower for ships which visited various California ports in 1976 and 1979. In developing emissions inventories, the staff took into account the differences in powerplant sizes of vessels that operate in California Coastal Waters.

Shoreside facilities for which sulfur dioxide emission controls are required are comparable in size to marine vessel boilers and engines, and many are smaller than typical marine vessel power plants. Industrial boilers and process heaters in the South Coast Air Basin have heat input capabilities as small as 25 million Btus/hr;[12/] steam generators used in oil production operations in Kern County have heat input capacities of 20 to 60 million Btus/hour.[13/] To control sulfur dioxide emissions in the South Coast Air Basin, boilers and heaters that burn oil are required to burn low sulfur fuel oil and most steam generators in Kern County are equipped with stack gas

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* However, a small commercial fishing vessel can have a power rating of 100 to 200 SHP.

TABLE VII-4
POWERPLANT REQUIREMENTS FOR TANKERS, BY DEADWEIGHT TON

Displacement D.W.T.	Power SHP
10,000	6,000
15,000	10,000
25,000	12,000
50,000	20,000
100,000	25,000
200,000	30,000
300,000	40,000
500,000	60,000
550,000	65,000

Sources: Air Pollution Impact of Maritime Shipping Operations in the Port of Houston, Texas A & M University, November 5, 1973.

The Tanker Register, H. Clarkson & Company Limited, London, England, 1981.

TABLE VII-5
MAXIMUM POWERPLANT REQUIREMENTS FOR COMMERCIAL MARINE VESSELS

Type of Vessel	Maximum Power SHP
Bulk Carrier	40,000
Oil Tanker	65,000
Container Ship	80,000

Sources: Air Pollution Impact of Maritime Shipping Operations in the Port of Houston, Texas A & M University, November 5, 1973.

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